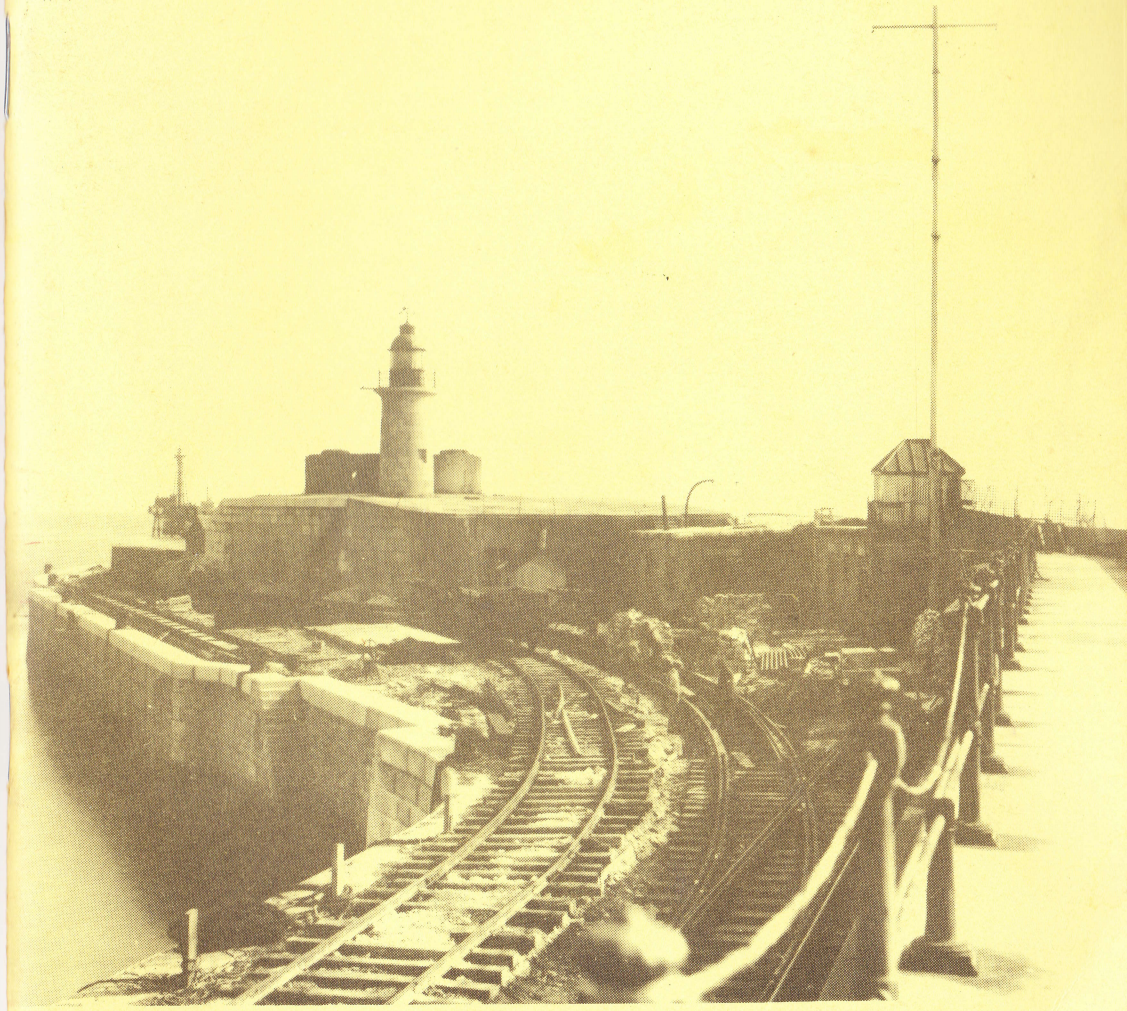
THE DOVER TURRET

ADMIRALTY PIER FORT



David Burridge

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Front Cover: The turret during widening operations Nov. 1907 (Dover Museum Collection)

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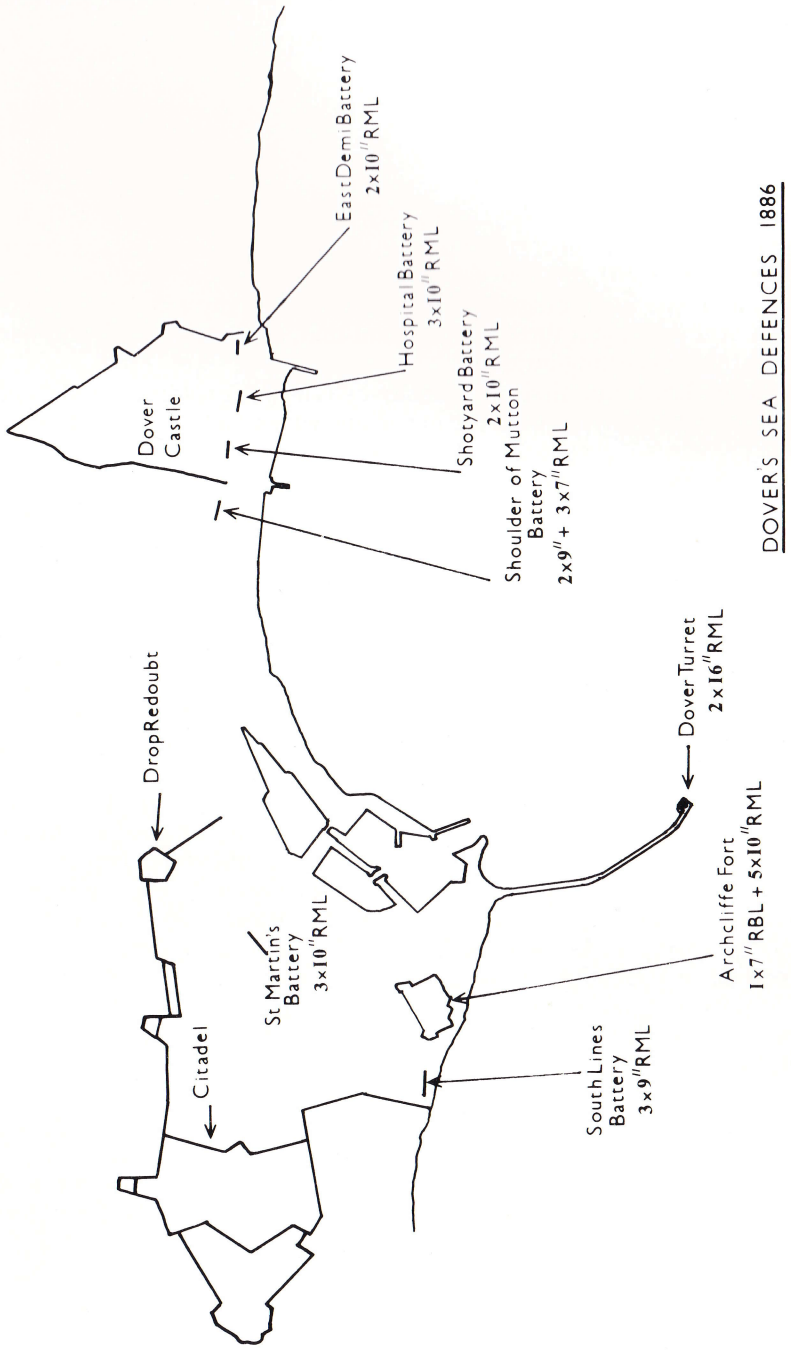
ADMIRALTY PIER FORT

by

David Burridge



Preface

I was introduced to the Admiralty Pier Fort, or Turret, by my wife. In common, I suspect, with most other people in Dover, I had always assumed (if I considered it at all) that the large, drum-shaped object halfway along the Admiralty Pier was a storage tank of some kind, but my wife knew better. She knew that it was a gun turret. More than that, she knew that it still had two 16″, 80-ton guns sitting inside it.

My wife's late father first came to Dover as a young soldier in 1909, and one of his first duties was to guard the aeroplane which had just been flown across the channel by a Monsieur Bleriot (the young soldier shown in a contempoary postcard of the scene might even be him). Soon after this he helped to install the 6″ guns of Pier Turret Battery, and shortly after the Great War he returned to the battery, this time as caretaker. He converted the battery quarters into living accommodation and lived on the Pier with his family until the Munich Crisis in 1938 forced a hurried removal to allow the Army to move back in. Thus it was that my wife came to know the Turret.

During a walk along the Pier my wife pointed out to me the foundations of the quarters, now long gone, and the entrance to the magazine; and I found that by pressing one eye to a small ventilation hole in the turret's door (formerly a gun-port) I could just discern the massive shape of a gun crouching in the gloom within.

Mr Jim Butler of the Dover Harbour Board kindly arranged for us to visit the Turret, and after seeing the guns at close quarters and exploring the chambers of the Fort, I resolved to find out all I could of its history.

This, however, was not as easy as I thought it would be — very little on the Turret has been published, and I was therefore compelled to go back to contemporary offical and newspaper reports. From these it very soon emerged that a good deal of the published material on the Turret was, at best, unverified or, at worst, incorrect. Therefore, with one exception, I have used only prime sources in compiling this book and it should be, as a result, the most accurate history of the Turret so far.

Note: The Admiralty Pier Fort seems to have become known very soon as the 'Dover Turret' or, to locals, 'the Turret'. Throughout the book, Turret with a capital 'T' should be taken as meaning the Fort as a whole: turret with a lower-case 't' refers to the actual circular turret which housed the Fort's guns.

Introduction

For much of the 18th century, and for the first few years of the 19th, a state of war or, at best, of uneasy truce existed between Britain and France. As a result, many new defensive works were built, or existing works strengthened. After Napoleon's final defeat at Waterloo, expenditure on defence seems very largely to have ceased, until fresh sabre rattling by Napoleon III brought fresh fears of invasion.

That these fears were very real cannot be doubted: General Sir John Burgoyne stated, in his 'Memorandum on Defences for Great Britain' in November 1856, "...it is conceived that preparations might be made by France, with little or no show of the design, so that, within a very few weeks (perhaps to be counted by days) a force of 50,000 men could be thrown on our shore..." and, of the country's military ports, "Those which call more especially for attention ... are ... Portsmouth and Dover ... Dover is in the centre of the part most threatened: it is the point nearest to France, and that which, of all others, it would be most advantageous to the enemy to possess...".

The result of these fears was a Royal Commission, set up to consider the country's defences. The Commissioners' report, in 1860, set off another round of fort construction or improvement, resulting, at Dover, in the completion of work begun long before on the Western Heights and at the Castle, and in the construction of Castle Hill Fort, soon re-named Fort Burgoyne, on ground to the north of the Castle to guard it from that side.

At Dover, fears of invasion had, perhaps, even more justification than before, for the construction of the Admiralty Pier had begun. This promised to provide berths for ships to unload whatever the state of the tide and, whatever its benefits in peacetime, it seemed to offer an enemy bent on invasion too good a chance to miss. The military thought so, too. In a "memorandum relative to the Protection of Dockyards and most important Harbours..." of October 29th 1858, Major W. E. Jervois observed "Batteries on the breakwater will be required, when that work has progressed sufficiently far out to afford the necessary sites."

The commissioners obviously took the point, for in February 1874 Jervois, now a Colonel, Deputy Director of Fortifications, and secretary to the Defence Committee reported not only that "The fortifications at Dover are for the purpose of denying the use of the harbour to an enemy, — to prevent him seizing a position, which is the most favourable he could occupy as a tete-du-pont for invasion...", but "A work is also being constructed at the end of the Admiralty Pier for the reception of a turret armed with two very powerful guns." 'the Defence Committee having approved, on December 19, 1870 "the design submitted to them for the construction of a turret for two of the most powerful guns at the extremity of the Pier".'

The Dover Turret, if it had not yet been born, had at least been conceived.

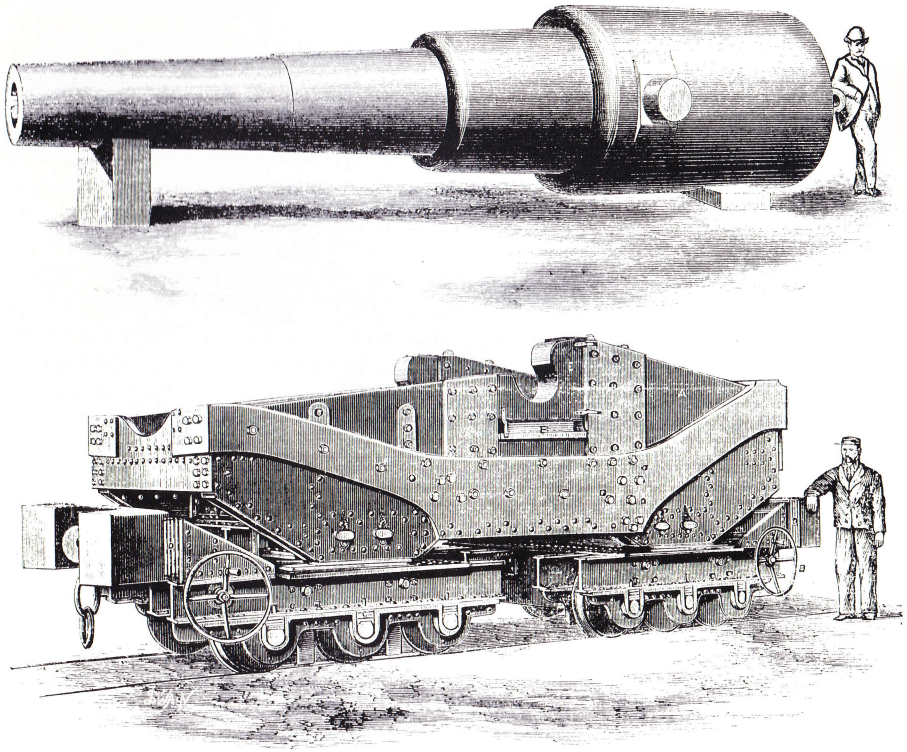
The pier before building the fort (Dover Harbour Board)

THE GUN

On October 21st, 1873 a meeting of Heads of Departments was held at the War Office. During the meeting the Director of Naval Ordnance stated that "a gun was required for the future armament of H.M.S Inflexible, and vessels of that class, which would be capable of penetrating 20 inches of iron at a range of 1,000 yards." The Superintendent of the Royal Gun Factory was accordingly asked to design such a gun and, on November 3rd, he submitted his design for a gun of approximately 60 tons weight and 15″ bore, to fire a 1350 pound projectile with a charge of 230 pounds. It was decided at an adjournment meeting to recommend a gun of approximately 75 tons, with a bore of 14″ but capable of being bored first to 15″ and then 16″. The Royal Gun Factory's Superintendent produced a design, no W.3913, for such a gun and on March 11th, 1874 the Secretary of State for War authorised its construction, at an estimated cost of £8,000.

The gun took eighteen months to build. The largest gun then in service was the 12″ RML, or Rifled Muzzle-loading gun, weighing 38 tons, and a great deal of work had to be done at the Royal Gun Factory before construction of the new monster could begin. New machinery had to be installed; at least one roof had to be raised; a crane had to be strengthened, and every bridge over which the gun was to be taken had to be reinforced to take its weight. Finally, however, in September 1875 the gun, with a bore of 14½″, was ready for

firing. A special barge, "Magog", had been built to carry the gun to Shoeburyness, with rails laid in its floor and opening doors in its bow. On arrival the gun, mounted on a specially built carriage with two six-wheeled bogies, was hauled off the barge onto track which had been laid to receive it and taken to the proving butts.



The Gun and Carriage (The Engineer, 24 Sept. 1875)

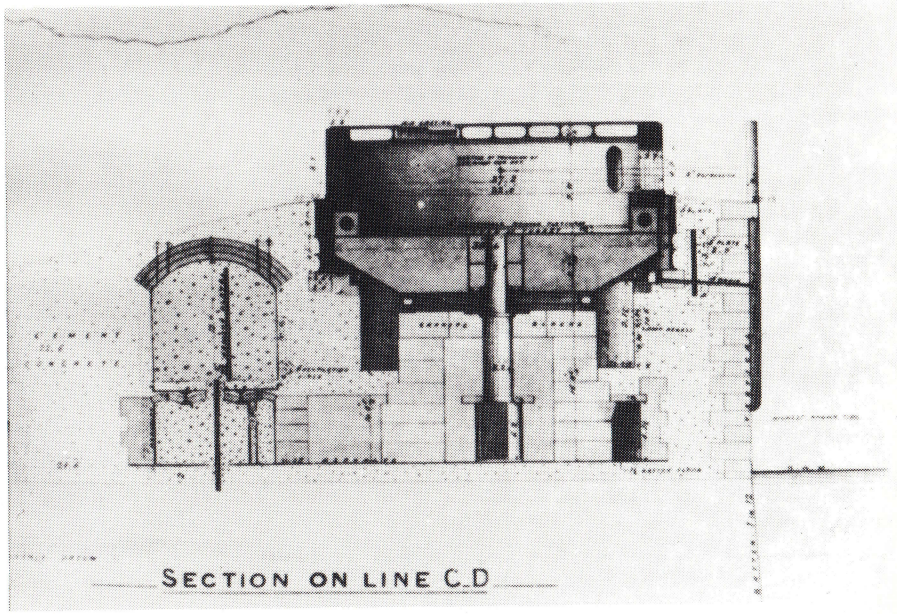
The carriage itself was quite an engineering achievement. Weighing 30 tons and built of wrought iron, it was intended not only for transporting the gun but for supporting it for firing. A large wooden buttress was placed behind the trunnion block to take the shock of the recoil and buffers and springs "consisting of inch layers between iron plates of india-rubber" were fitted, with more rubber under the trunnion block and between it and the wooden buttress (and all this almost 85 years before the Mini, with its 'innovatory' rubber suspension!).

For firing the gun was hauled on its carriage to a stretch of line with a gradient behind it, its recoil not being braked in any way. Six rounds were fired and, the gun having behaved itself, it was taken back to Woolwich to be bored to 15″. This was done and on March 29th, 1876 the Special Committee

on the Working of Heavy Guns reported that 32 rounds had been fired, with a maximum charge of 303 pounds. The gun was now 'chambered', i.e. its powder chamber was enlarged, to 16″ and a further 21 rounds were fired, with a maximum charge of 310 pounds, and then it was bored to 16″ and 27 rounds fired, with charges of from 250 to 370 pounds, then it was chambered to 18″. The final recommendation was that the gun should fire a 1700 pound projectile with 370 pound charge.

'On May 10th, 1877, referring to "their recommendation ... that the two guns for the turret ... should be 12-inch 35 ton guns, that nature being the most powerful gun in existence at that date, the Defence Committee noted that since that time the manufacture has advanced to guns of 80 tons".'

In the March 1875 report of the Director of Artillery and Stores, the Superintendent of the Royal Carriage (i.e. gun-carriage) Department had stated that "it is probable that 81-tons guns will be placed in land-service turrets...". Indeed, a "rough model of land service turret for 81-ton guns with hydraulic apparatus for working the gun..." was ready for inspection by April 1875. There is a reference in the report of a meeting of Heads of Department on October 8th, 1878 to "the two (guns) now being manufactured for land service", and the 'Dover Chronicle' of June 25th 1881 reported that "the 80-ton guns ordered for the defence of Dover Harbour are nearly finished, at Woolwich, and will be sent to the proof butts in a few days". In the meantime, a good deal had been happening at Dover.



Plan of the Turret (Public Record Office WO78/5106)

THE FORT

According to the Public Record Office plans of the Admiralty Pier Fort, work on it commenced in January 1872, but the reports of Edward Druce, the engineer in charge of the work, give the date of commencement as September 1871. This may, however, be the date at which the contractors, Henry Lee & Sons, began "erecting the necessary staging and temporary plant for carrying out the work", for in January 1872 Druce reported that "the diving bells have commenced preparing the foundations of the fort". Quite what form this fort was intended to take is not clear. Certainly it was not at first intended to be the Admiralty Pier Fort that it became, for the gun had not at this time even been mentioned for use at sea, let alone for land service. A report of 1870, printed in 1873, states "A foundation for a new battery has now (1872) been commenced at the existing end of the pier, by widening the further extension of it sufficiently for that purpose", which suggests that a fairly simple affair was at first envisaged. By January 1874, however, Druce reported that the substructure of the fort was complete, at a total cost of £19,718:4:0 (£19,718.20), almost £300 less than the estimate of £20,000. Lee & Sons were now given a second contract and started work on the fort itself, i.e. the part of it above high water mark. By April 21st, 1874, Druce reported to the Board of Trade: "the fort, which is being executed by the Board of Trade for the War Department, has been raised from high water to 5 feet above that level", and by July of that year the work was up "to the level of the quay, and the contractors have commenced removing their temporary staging and other plant". The total cost of the work to date was £23,047:0:6 (£23,047.02½).

In his report for 1874 the Director of Artillery and Stores stated that "The following points connected with the subject of working 81-ton guns in land-service turrets are under the consideration of the Special Committee on The Working of Heavy Guns, appointed in June 1872, viz:-

1. The nature of the carriage and platform best suited for the purpose.
2. The means to be adopted for working them, whether by hydraulic or steam machinery, or both.
3. The space required for working the gun and carriage.
4. The requirements for mounting a gun in such a structure."

During the first quarter of 1875 drawings of the proposed turret, loading gear carriage and slide, and power rammer were circulating among members of the Committee. From what descriptions of these are given they appear to be similar to the designs for the machinery that was finally installed at the Turret.

For the next two years little seems to have happened. We may assume perhaps that the Committee on the Working of Heavy Guns considered the drawings and may have had smaller versions, half-size maybe, of some the items of machinery built, for between the 11th and 27th of June and the 9th and 10th of July, 1877, they gathered at Shoeburyness to test steam gear for the working of a 38-ton RML. The Director of Artillery, in the meantime, appears to have become a little impatient, for on February 11th he "informs Committee that 2 — 80-ton guns are in hand, and a turret for them is

Admiralty Pier after the great storm of 1 Jan. 1877 (Dover Harbour Board)

designed; it is therefore desirable that the designs for carriages should be considered and settled." This was followed up on June 1st with a request for an "early report".

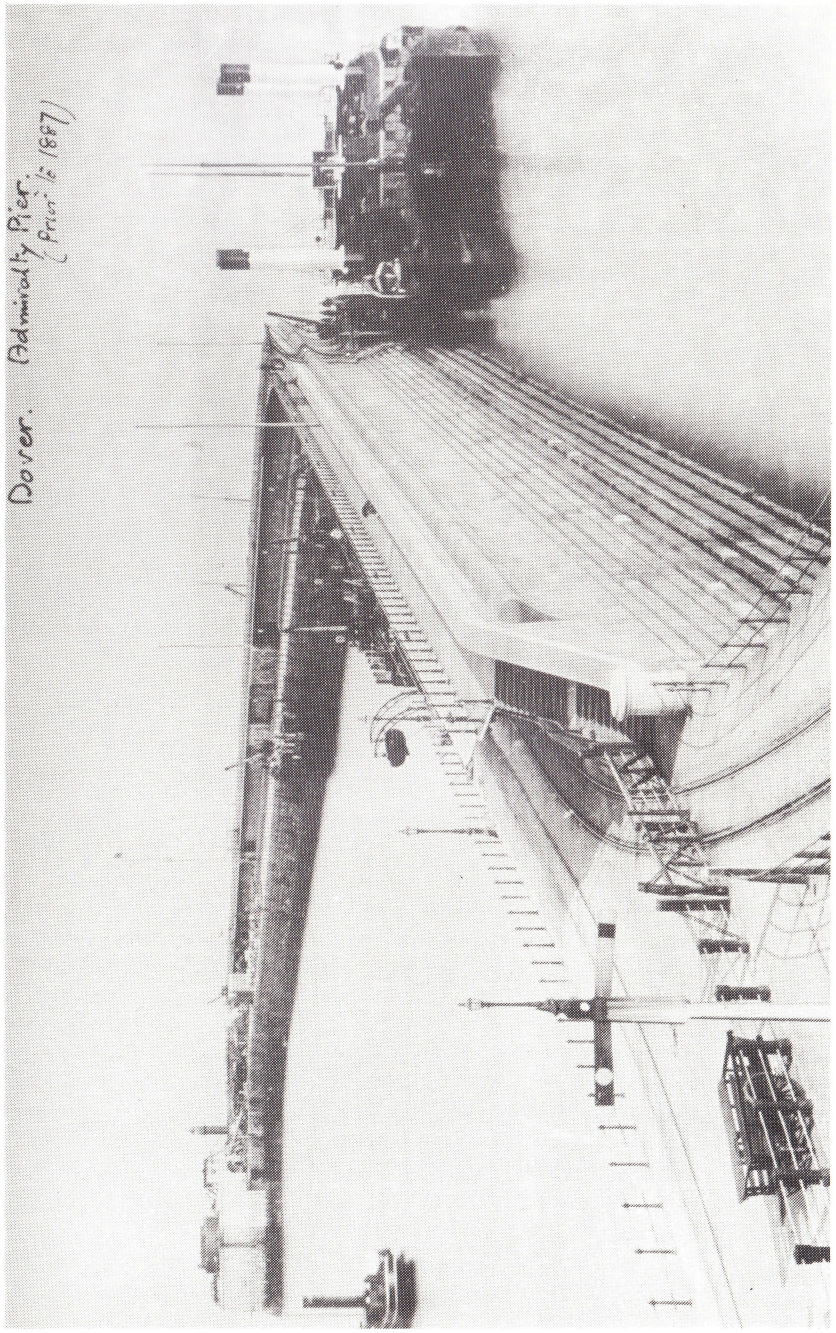
The Committee evidently obliged — in June of the following year the 'Folkestone Chronicle' reported that "workmen are busily engaged in cutting a portion of the stonework away at the back or north side of the fort to allow the erection of ... machinery for the purpose of loading the guns. The fort will not, however, it is expected, be complete until about next May". The turret itself, and the steam engines and machinery, were built by the Thames Iron Works and Ship Building Company, Ltd, of Blackwall, under the direction of their Chief Engineer, Richard Hodson.

MOUNTING THE GUNS

In the Autumn of 1879 the question of transporting and mounting the guns, and the 100-ton guns which were being constructed for use at Malta and Gibraltar, was referred to the Special Committee on the Working of Heavy Guns. It was at first proposed to transport the guns to Dover by rail, and sketches of 16-wheeled railway trucks were prepared by the 'Iron Fortification Branch', and the General Manager of the South-Eastern Railway produced a model of a truck "of somewhat similar character". As such a truck was likely to cost £1500 to £1600, and would be no use for anything else, it was finally decided to send the guns by sea. (Why, one may wonder, was the special carriage built for use at Shoeburyness not used?)

The crane of "the new T Pier" at Woolwich Arsenal had been found to be capable of handling the guns, so there would be no trouble in loading them onto a ship, but there were, of course, no such facilities at their destinations. Clearly, some sort of lifting apparatus would have to be built at each place to unload the guns. "Officers of the Iron Fortification Branch who were serving as members of the Committee, and who had for some time previous been giving their attention to this and similar matters" designed what they termed "derrick sheers", which it was felt should answer the purpose. They had a safe working load of 120 tons and could be braced to take more; they were relatively simple to erect and dismantle, so that after they had been used at Dover they could be shipped out to Malta and Gibraltar for use there; and because of the very restricted space on the Admiralty Pier at Dover, they were compact and powered by muscle rather than by steam. They were designed to sit on top of two massive blocks of brickwork capped with stone, with their tails protuding over the outer side of the pier and secured by holdfasts set into the wall.

To lift the guns onto the top of the fort from the quayside, and to lower them into the turret, a "traveller" was devised. This, mounted on wooden supports, would be placed on the top of the fort with one end overhanging the quay and each gun would then be hoisted up by means of hydraulic jacks and hauled to the other end of the traveller before being lowered again.



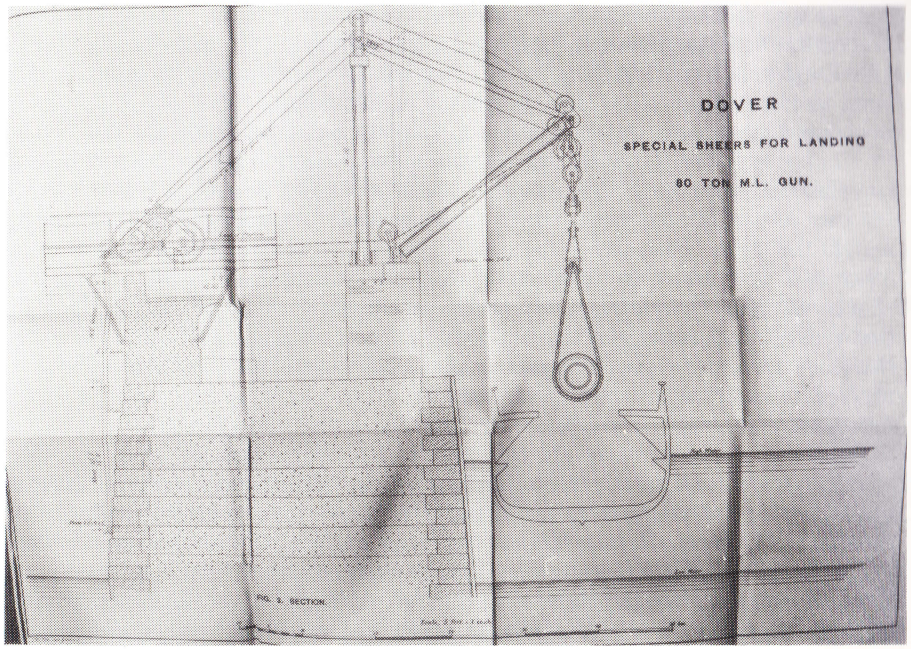
Admiralty Pier 1881/82 with brick and masonry block for 'derrick sheers' visible (Kent County Library)

The Committee approved the designs and, on January 16th, 1880 "recommended the contruction of two derrick sheers, in general accordance with sketch 31,559, and of one overhead traveller, in general accordance with sketch 31,554.". Two sets of sheers and one traveller were ordered from Messrs. Tannett, Walker & Co, of Leeds, on September 25th, 1880 and January 21st, 1881 respectively, and "immediately afterwards" a second traveller was ordered, it being considered that some expense might be spared by having two. The sheers weighed 100 tons and cost £3,286 per set; the travellers weighed 22 tons 8 cwt and cost £782 each. It was reckoned that the sheers would cost £350 a time to erect and the travellers £100 to £150 depending on the amount of timber required.

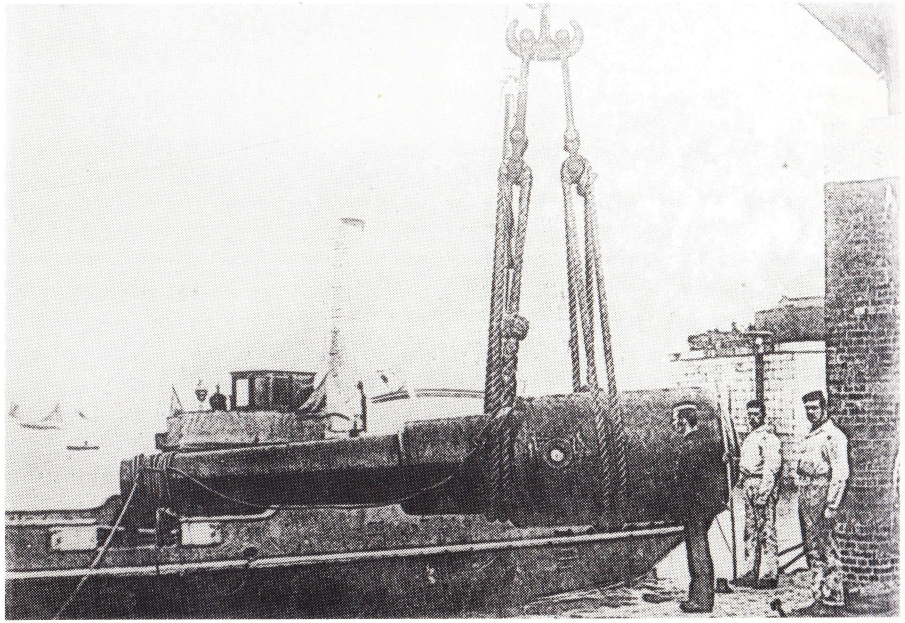
Permission was sought, and obtained, from the Board of Trade in the Autumn of 1880 to erect two blocks of "masonry and brickwork in cement" 15 feet high, 7 feet wide and 10 feet deep, capped with granite blocks, on the Admiralty Pier, and to insert holdfasts in the Pier's outer wall, 32 feet below the parapet. The Board of Trade's permission was conditional on the Pier's being restored to its original state as soon as possible after the guns were landed. The 'Dover Chronicle' of June 25th, 1881 reported that "An enormous pair of sheer-legs are being prepared for the purpose of landing (the guns), and will afterwards, if satisfactory ... be employed to land the 100-ton guns for the defence of Gibraltar and Malta ...", adding gloomily that "It is said that (the guns) can never be used at the Pier or that the Pier can never be used after they have been fired ...".

The sheers were sent to Dover by rail and erected, and testing began on October 17th, 1881. Owing to the need to replace one part which failed under strain, testing was not completed until November 7th, when 110 tons of railway line were lifted, swung out from the quayside and left, with the lifting chain stopped, while the men went for lunch. Sixty men lifted this weigh easily, forty managed it "without difficulty", their muscle power being converted into lift by means of a capstan.

The first gun arrived at Dover on board the W.D. vessel "Stanley" on Sunday, December 4th, 1881, a week after gales had lashed the Admiralty Pier and severely damaged the woodwork of the sheers' platform and shifted the capstan. The 'Dover Standard', reporting the damage caused by the storm of "the 27th ult. ..." stated that "The whole of the staging around the capstan attached to the sheers had been washed away, and the iron work generally had to be examined and strengthened where necessary. Some of the staging at the turret had also to be replaced, and besides the damage incurred to the engines by the water getting into the underground chambers at the turret, a good deal of 'smithing' was rendered necessary by the fact that the sea had almost doubled up some of the steel rails upon which the gun was to travel after being landed." The 'Dover Telegraph' of December 14th reported much the same damage but also regaled its readers with the fact the "The gun slings and iron trolley as well as other materials washed off the Pier in the recently disastrous gale were recovered by divers.".



Special Sheers for landing the Guns (M.O.D. Whitehall Library)



Landing 80-ton R.M.L. Gun on Dover Pier (M.O.D. Whitehall Library)

Men had worked around the clock to rectify the damage and on Tuesday, December 6th, the "Stanley" left her berth "alongside the quay (in the Granville Dock) opposite Mr. Bradley's corn store" and steamed out to the Pier. It was, as the 'Dover Standard' observed, a ideal day. "The weather was in every way favourable to the operations. It was particularly bright and cheerful. There was hardly sufficient wind to raise a ripple on the water, and the sun shone forth with the warmth of a summer's day." It was probably largely for this reason that a large crowd had assembled "outside of the gates" to watch the fun. They were, however, destined to be disappointed. The "Stanley" arrived at the Pier at 10 a.m., an hour before high tide, but the sheers were so slow and cumbersome in operation (or the men operating them were so unpractised) that it was an hour after high tide by the time that the jib was directly over the gun, and by then the chains were too short to reach it. The "Stanley" therefore returned to her berth, where several of the more important spectators were invited on board to inspect the gun more closely.

A telegraph was sent to Woolwich for a sling of 15″ rope, and this arrived the following morning, in time for the second attempt to land the gun. This time the weather was not so kind and, as a result, the attempt was abandoned. Or so says the official report. The 'Dover Standard' was less kind: "so much time was occupied by preliminaries, that when everything was pronounced to be in readiness at 12.30, it was found that the tide had fallen off, and the chain again would not reach the slings...". The 15″ rope was added to the lifting chains "But this again occupied so much time that ... it was found impossible to reach the slings, and the attempt was then abandoned, the vessel shortly afterwards steaming into harbour.".

On Thursday, acting no doubt on the maxim of Robert the Bruce, the Master of the "Stanley" brought his vessel out to the Pier yet again. This time, however, the military were ready for him. It had been decided "and wisely too" declared the 'Standard' sagely, "that the preparations for lifting should not be left until the last moment, but should be done before the vessel left the harbour...". Accordingly, when the "Stanley" reached the Pier, nothing remained to be done but to make fast the slings and give the order to "walk her up". Once more, a large crowd had gathered, encouraged, no doubt, by the weather again: "The morning was just such a one as Tuesday", the 'Standard' reported lyrically, as usual, "With a cloudless sky the sun shone forth brilliantly and there was just sufficient wind to disturb the water into a graceful ripple which imparted a grateful and inviting aspect to the scene.".

This time the spectators were not to be disappointed. Slowly, the huge gun was lifted from the "Stanley, which rose in the water by two feet as the weight was taken off her, and lowered gently onto railway sleepers placed on the quay in readiness for it. On Friday and Saturday the weather was very bad, and the gun was not lifted onto the carriage until Monday, December 12th.

On Friday, December 16th, the "Stanley" arrived at Dover with the second gun. All was made ready for it over the weekend and on Monday the

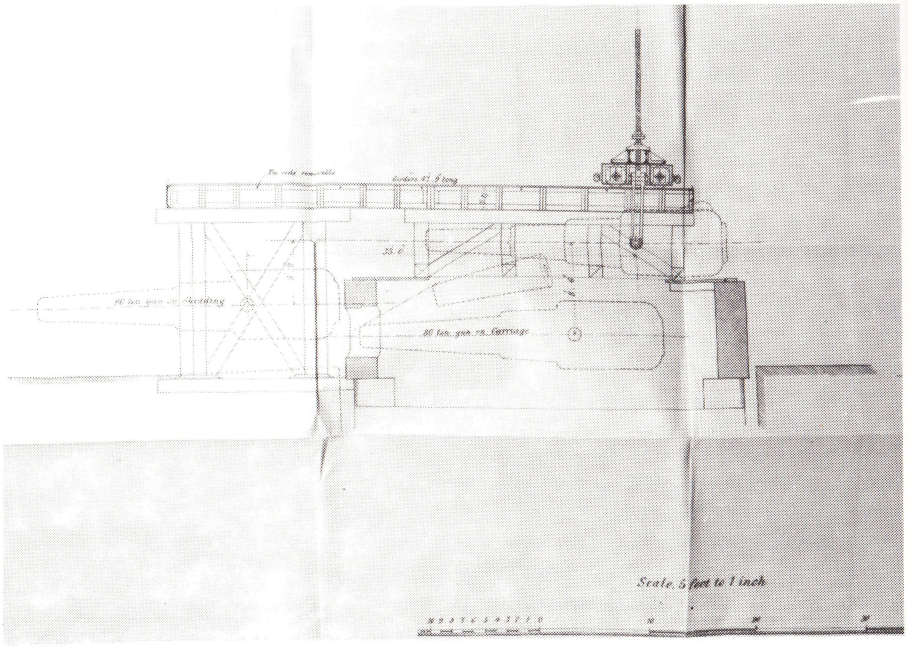
"Stanley" steamed out to the Pier and the gun was landed with no problems, being placed on the the railway sleepers previously occupied by its twin "until the bogey, on which the other gun was resting, should be disengaged". The 'bogey' was a truck contrived out of two which had been build to move 38-ton guns at Cliff End Fort, Isle of Wight, and was fitted with jacks between its axles so that it could be 'bent in the middle for sharp curves.

Rails had been laid from the landing point to the Turret and the truck was hauled along them with a windlass at the Turret entrance. "This is a very slow job indeed", lamented the 'Dover Telegraph', "and the progress the gun makes is barely perceptible, although the amount of rope which is wound round the windlass shows they must be advancing by small degrees.". In fact it took until December 23rd to get No. 1 gun to the Turret and off the truck, and No. 2 was then lifted onto it. Considerable trouble was experienced in moving the guns. Some of the temporary sleepers were of poor quality and, there being insufficient rails (perhaps some had been too badly damaged by the storm to be used) they had at some points to be lifted from behind the truck and re-laid in front of it. As a result, by the time the job was finished several rails were quite badly twisted. The task was completed at last, though, and preparations were made for lifting the guns onto the top of the Fort.

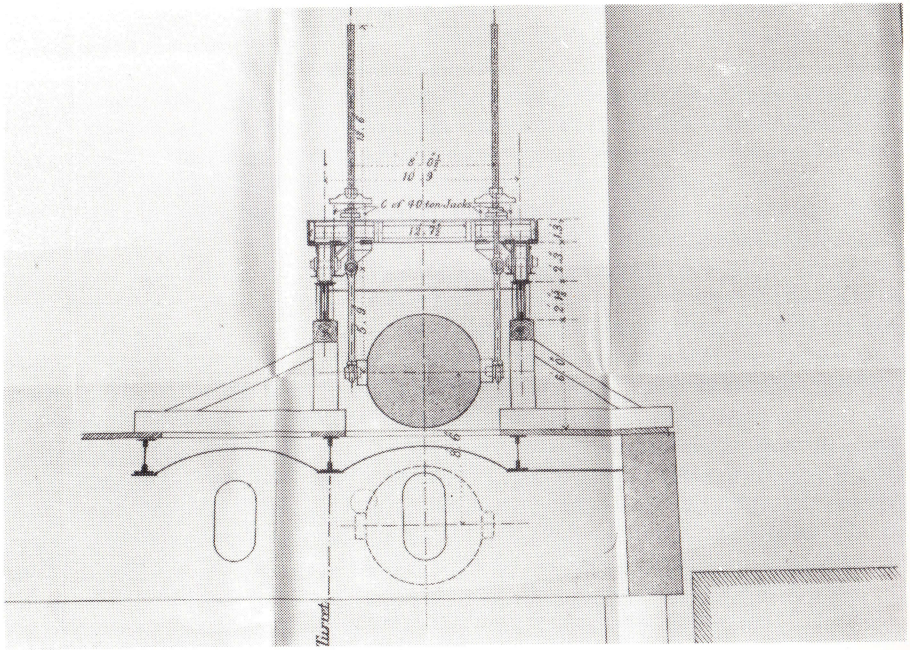
The traveller's hydraulic jacks caused problems — "The ... jacks did not work well at times and constant delay was caused by having to lower them for repair. When all four jacks were in good order, a rate of lift of 3 feet per hour was obtained" reported Colonel Inglis, R.E., in charge of operations. The weather did not help either — "with the wind blowing as it did on Friday morning and an occasional sea breaking over the pier the work was fraught with ... danger to the operators" said the 'Standard', sympathetically.

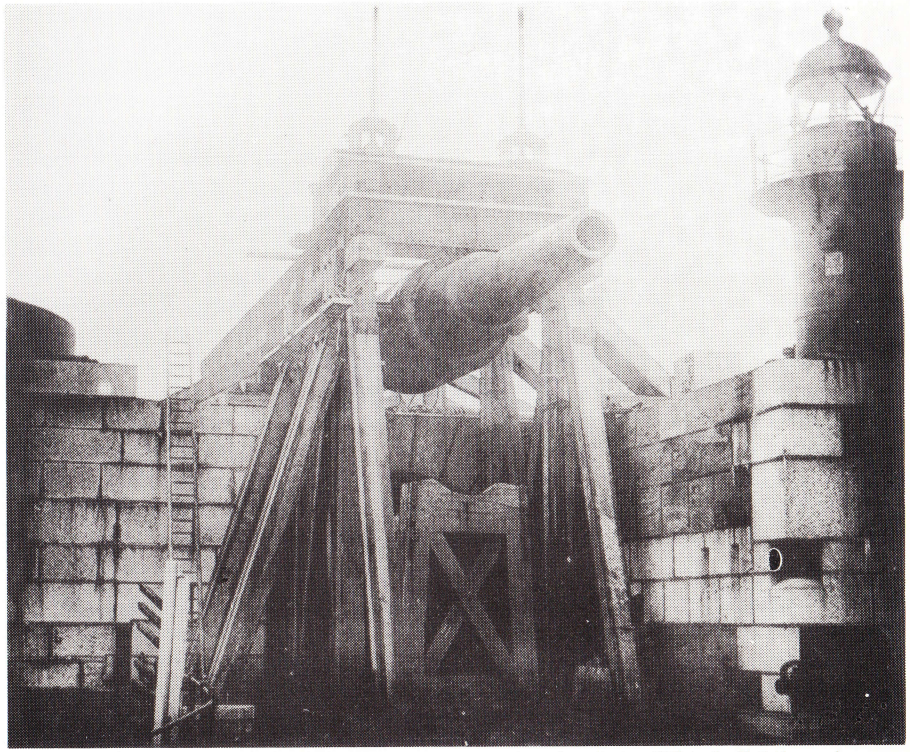
The traveller was a clever piece of work and the 'Standard' reporter was duly impressed, telling readers that "The jacks lift ... about a foot each time before a fresh purchase is required. A couple of large nuts are worked down as the screw rises, to take the weight of the gun, so that the jacks can be re-adjusted without the slightest danger of the gun falling". The traveller only had a nine-foot lift, and at that height the gun had to be supported on staging while the slings were shortened for a second lift to be made. No. 1 gun was finally lifted over the Fort's parapet on January 6th 1882, and on the 7th it was taken off the traveller for No 2 to be lifted.

As each gun came off the traveller it was put on a "trunnion sleigh", a large gun-carriage with steel plates along the bottom of each cheek on which it ran on rollers. The guns were moved to the turret and the traveller was placed over the top of the turret to lower the guns into place within. The openings in the turret roof were slightly shorter than the guns, so the muzzles had to be dipped through first, and then the gun inched along until its breech was clear of the rear of the opening. A further complication was that the openings gave a clearance of only ¼″ each side of the trunnions, so the slings' retaining washers had to be removed as the gun was lowered through the roof. The very restricted clearance would have prevented the slings from coming off the trunnions, but just in case the guns were lowered only one inch at a time.



Sections through the 'traveller' (M.O.D. Whitehall Library)





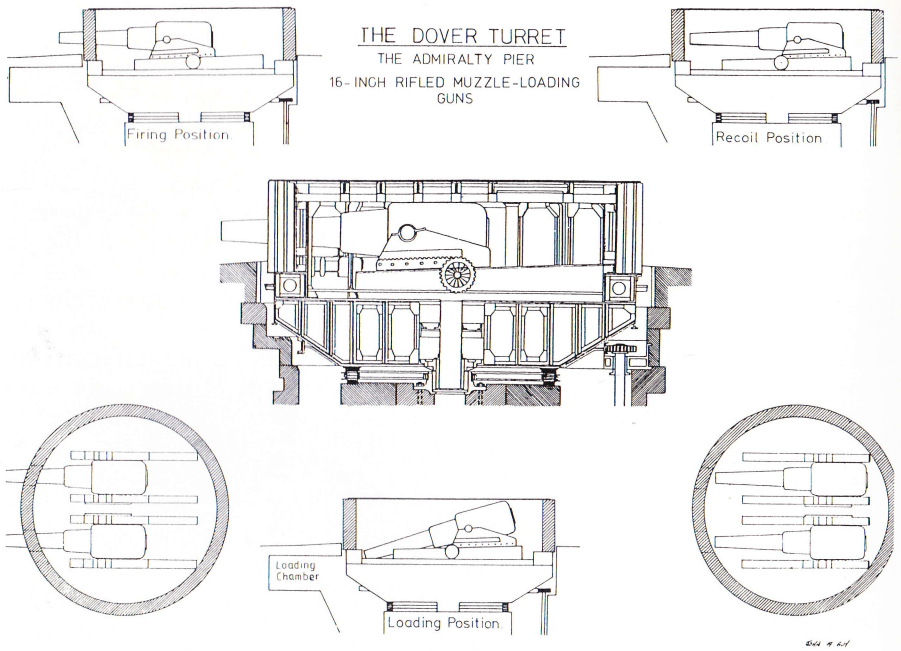
Gun raised to Glacis of Turret on its 'traveller' (M.O.D. Whitehall Library)

Mounting of the second gun was finally completed on May 12th 1882.

There is a tradition locally, reported as fact by at least two local newspapers in recent years (and, I am ashamed to admit, used by myself in a magazine article) that the guns were hoisted into the turret by the combined efforts of 1,000 or more men from the town's three garrison batalions, strung out along the pier and hauling manfully on ropes to the accompaniment of a military band. Inglis' official report makes it quite clear that no such thing ever happened — a pity: it made a good story.

TESTING AND SUBSEQUENT HISTORY

Work on the Turret's machinery continued, and by the beginning of 1883 the Superintendent of the Royal Carriage Department was ready to test the turret and guns. A delay was caused by "urgent representations made by the the Corporation of Dover as to the injurious effect to be expected in the cliff from the concussion of the firing." and an eminent civil engineer was engaged to examine the cliffs. His report was to the effect that they would come to no harm, and a firing test was arranged for July. The 'Dover Express' of July



16 inch R.M.L. Guns at Dover Turret (John Guy)

20th, 1883, referring to "previous rumours of the damage that the firing might do", reported that windows were opened all over the town and "immense crowds turned out on the Sea-front to witness the effects." They had a long wait, for the "Woolwich Committee" (presumably the Committee on the Working of Heavy Guns) did not arrive until noon, and it was another hour before shipping cleared sufficiently for the guns to be fired safely.

Finally, a little after 1 p.m. "an immense volume of smoke belched forth, and very shortly, at what appeared but a mile distant, the projectile struck the water and made three more appearances at a great distance." This first shot was fired with a 250 pound charge. A second shot was fired with a 337 pound charge, and finally three shots were fired with "a full battering charge of four hundred and fifty pounds of powder." (the Committee on Ordnance had fired an 80-ton gun in October 1881 with a 450 pound charge: evidently they liked the effect). The whole affair seems to have been a bit of an anti-climax. The cliffs did not fall down, the Fort did not disintegrate and contrary to the dismal predictions of the 'Dover Chronicle' a couple of years earlier, the Pier remained usable. Two cups filled with water were placed at the ends of a "nicely balanced" piece of wood in the magazine and not a drop was spilt". As some consolation to the pessimists, however, a couple of panes of glass in the nearby lighthouse were broken.

The delay caused by the "Woolwich Committee" not arriving until noon allowed the gentlemen of the press to be shown the inner workings of the Turret, and the 'Express' reporter seems to have been deeply impressed, informing his readers that "the turret itself revolves on thirty-two wheels...", that "the recoil after discharch is eight feet six inches" and that there was "some very ingeniously contrived machinery by which the charge of 450 lbs. of powder and the shell of 1700 lbs., are put into the gun from a loading chamber within the turret with the aid of a small engine ... In the base of the turret is a large magazine over which there are lifts and appliances by which the guns can be loaded in two minutes and a half." On this occasion, however "the loading of the guns was ... done from the outside owing to the machinery in the loading chamber not being ready". On this occasion too, the Turret's own magazine was not used, the cartridges and Palliser shot being stored at Archcliffe Fort until needed. The Director of Artillery and Stores, in his annual report dated May 1st, 1884 expressed his satisfaction with the firing test — "The result was satisfactory as far as the working of the guns was concerned, and we are proceeding to complete the fittings." The Superintendent of the Royal Carriage Department reported that "The loading gear for the 80-ton guns at Dover Turret is practically complete. There still remains some work to be done in perfecting the locking gear."

The Committee on Sea-Coast Batteries and on Electric Firing visited the Turret and reported, in May 1884 that "Of the works visited by the Committee, that for which position-finding appears to be most essential is the Dover Turret...". The Committee went on to recommend a depression range-finder on the Western Heights, communicating with the Turret by means of electrical cables. Work at the Turret, however, appears suddenly to have been afflicted by a curious lack of urgency. The Director of Artillery and Stores reported on May 1st, 1885 that "More time than was anticipated has been occupied in preparing and completing the intricate details for the interior arrangements of the turret and the means of working the guns. These are, however, on the eve of completion...". A year later, however, he was still reporting that "More time than was anticipated in my report of last year has been consumed in preparing and completing the turret and its workings...". He had some excuse, though. A lot had happened at Dover.

As first built, the Admiralty Pier Fort was approximately square in plan, as was the pier-head on which it stood. At quay level was the entrance, leading into a wide passage which ran through the pier-head from landward to seaward with, it seems, another opening at the seaward end. From this main passage, two more led off to the left. The first led past the gas and water meters, in a recess with a hatchway to the basement, to the space under the turret. This chamber was circular in shape, with the turret's plinth at its centre. Diametrically opposite the passage leading into the chamber was an iron ladder down to the basement, set in a recess; and at the other two points of the compass, so to speak, were the shell lift from below and the ammunition hoist to the loading chamber above.

The second passage off the main passage led down, via a curving stairway, to the basement, emerging just outside the magazine. This consisted of three linked chambers, presumably one each for shells, solid shot and cartridges, with a lighting passage alongside them from which gas lamps lit the magazine through thickly glazed windows, thus keeping flame and powder well apart. Just outside the magazine entrance was the shell lift referred to above, and from the entrance a passage ran round the turret's plinth to the foot of the ammunition lift. We may assume that the magazine had hatches in its ceiling, through which shells and cartridges were lowered from the main passage above on a hoist, and some sort of lifting gear to allow the shells to be moved around. Such a supposition is supported by the reference in the 'Dover Express' to "lifts and appliances" over the magazine. Next to the magazine and lighting passage, and separated from them by a thick granite wall, was the engine room.

By the end of 1885 the pier-head had been extended to landward, becoming almost half as large again. Within this extension were built:-

A. At quay level, a new shell store, with a passage cut through to the chamber under the turret,
B. At basement level, a coal bunker adjoining the end of the engine room, and separated from it by a bulkhead. This bulkhead and the coal bunker's ceiling of iron plates on girders, were "removeable to allow of boilers &c being taken in or out", and
C. Deep down in the extension, below low water mark so that it could be flooded whatever the state of the tide, a new cartridge store, with access by ladder from the shell store, and a cartridge lift to the foot of the ammunition lift.

Half of the old 'flanking gallery' outside the Fort's entrance, with its walls loopholed for rifle fire, was now inside the Fort, looking into the new shell store. This was filled in with concrete. Out on the quay-side were built a fitters' shop, a artillery store and a guard room, together with toilets for officers and men; and at this or a later time the lighthouse was moved from the edge of the pier (where it had prevented the guns from being fired in the general direction of Folkestone) to the top of the Fort (where it merely prevented them being fired down the pier). The new shell store now formed the Turret's main entrance, and it and the new cartridge store rendered the old magazine redundant. With a new entrance and the old magazine no longer necessary the old main passage, too, became redundant. Accordingly, it and the magazine were filled in with concrete, large quantities of armour plating being incorporated in the infilling. There is good reason to believe though, that this was not done until late 1891 or early 1892. A report of April 1st, 1893 states that "The strengthening of the magazine at the pier turret is now approaching completion.".

Possibly the most significant feature of the pier-head extension work was the provision of electric lighting. A "modified B.2 Victoria" dynamo and a "single cylinder double acting engine, by Yarrow" to drive it were mounted,

on a shared bed-plate to ensure accurate alignment, in a recess off the passage from the new shell store to the chamber under the turret. The dynamo gave 33 volts at a speed of 575 r.p.m. and powered 32 (later 33) lights around the Turret. Each light (except those in the engine room) had its own positive and negative wires from a switchboard mounted close to the dynamo, so that "any lamp can be at once disconnected without disturbing the other lamps, and the circuit of each lamp can be regularly tested." The switchboard also incorporated a Cardew voltmeter and an Ampere meter ... of a pattern invented by Mr. Cunynghame...".

During the first quarter of 1886 the Turret was visited twice by the Royal Artillery and Royal Engineers Works Committee, first to try working it with compressed air and then give it a final testing before its hand-over to the Royal Artillery.. The Turret's steam engines must have caused problems. In the first place, they meant that coal had to be stored at the Fort, and the business of carrying coal into the shell store (albeit only into the part in which solid shot was stored) and tipping it down a hatchway into the coal bunker below must have given nightmares to any sergeant in the least addicted to 'bull'. Then, of course, there was the heat, which would have wafted up through the engine room's vents into the chamber under the turret, and finally there was the smoke, which was discharged through a smoke stack on the landward side of the Fort. If the wind blew in the wrong direction it must have made life most uncomfortable for everyone and could well, by obstructing vision, have seriously affected the Turret's fighting capabilities.

Compressed air could have removed all of these problems. Compressors could be sited at virtually any distance from a fort, thus keeping coal, dirt and smoke away from it, the compressed air being carried to the fort's machinery by iron pipes. One could even argue that the boilers (always a potential hazard) would be much safer if they were sited some distance from the fort. Certainly it was worth trying out, and this the Works Committee did on January 25th, 1886, assembling "at Dover to witness the application of compressed air, as a substitute for steam, in working the engines of the turret...". The compressed air was supplied by compressors at the site of the Channel Tunnel Works, some two miles away, and brought to the Turret at "60lb. to 65lb. on the square inch" by means of wrought iron pipes "of 6 inches diameter for a distance of 2,850 yards from the compressors, and of 4 inches diameter for remaining 800 yards along the pier to the turret (no more 6-inch pipe being available).".

The Turret's two boilers were connected to the main steam pipe by a 'T' junction. For the trial this junction was removed and the compressed air pipe connected to the main steam pipe, with a stop valve and a pressure gauge fitted (the pressure guage promptly proved its worth by registering a pressure of 70 per square inch, higher than the pressure at the compressors. "This indicated pressure was ... obviously inaccurate, and the actual pressure ... may be taken as being equal to that at the head [viz., from 60lb. to 65lb. on the square inch], on the supposition that there was no leakage from the pipes."). The

turret's main engines were started and the turret turned several times, the loading engine was tried and performed satisfactorily, as did the pump for supplying water at high pressure to hose out the bores of the guns between rounds. The dynamo engine was run for short time but it was not deemed prudent to run it very long because of the tendency of compressed air to form ice out of water vapour as it decompresses "and it was feared that if this collected to such an extent as to interfere with the working of the engine, some damage might result on account of the extreme lightness of its parts and their very high velocity.". The Committee even tried making a hole of seven eighths of an inch in diameter in the main air pipe (presumably to simulate battle damage). This reduced the air pressure by 2 pounds per square inch, and had no effect on the working of the machinery. The hole was easily stopped "in two to three minutes by appliances at hand, consisting of a boiler cramp, a piece of flat iron, and some sheet india-rubber.". It was noticed during the trials that the Turret's smoke stack become completely covered by a layer of ice.

The Committee was obviously impressed by these tests. They were not prepared to say what effect compressed air would have on engines over a long period "as it was not considered prudent to ... risk ... damaging the engines by the intrusion, through the new pipes, of extraneous substances into the cylinders", but they were "of the opinion that the results of the trials are sufficiently encouraging to justify thorough and comprehensive investigation of the subject.".

The works committee gathered at the Turret again on Friday, March 12th, 1886. The Turret was put through its paces, four rounds were fired, (thus refuting local tradition, again, which asserts that the guns were only ever fired once) and "The Committee now report that the whole was found to be in a serviceable condition, and fit to be handed over.". There were, however, a few things about which the committee were not happy. The dynamo was one — the electric lighting was "in all respects efficient" but the committee were worried about the "great noise" made by the dynamo, which "to a large extent drowned the men's voices.". They suggested that it should, if possible, "be removed to some site outside the turret building.". It was also found that when the engines were running the speaking tubes to and from various parts of the Turret were almost ineffective and needed a man permanently stationed at each end. Some slight improvements were considered necessary at the projectile turntable (see Appendix) to make it more stable ("this will be at once carried out"), and in the passage from the cartridge store to allow more room ("this modification is, however, impracticable on account of constructive difficulties"). On one occasion the turret's locking bolt (again, see Appendix) stuck, apparently because of a slight taper on it ("this taper appears to be unnecessary and dangerous, and will be removed at once"); and there were considerable variations in steam pressure (from 60 to 110 pounds per square inch): these were put down to "unskilful stoking". It was found that, because of the "great and rapid variations of the load" the governor on the engines was not sufficient on its own and "it is necessary that a driver be always stationed at them.".

The most serious objection made by the Committee was to the fouling of the guns' bores. "The means of cleaning the bores when in action are limited to the use of the rammer and the jet (of water), and both of these, even conjointly, are but partially successful with the powder recently used, as was instanced by the increasing difficulty experienced in ramming home after each additional round. The use of brown prism powder is, with the present arrangement for loading, inadmissible. The Committee are strongly of the opinion that none but the cleanest burning powder should be used with these guns. It is estimated that a saving of three or four minutes per round would be gained by the use of a powder leaving a deposit smaller in quantity and more easily removeable..." (one may wonder what sort of firing rate could be reasonably expected if a "saving of three or four minutes per round" could be made). In fact, this problem had already been experienced during the test-firing of the 100-ton, 17.72" guns at Gibraltar, and with the 16" guns on H.M.S. 'Inflexible', where it "led to the filling of the bore with water with the gun at elevation — the water running out on depression.".

Yet the guns' Handbook of 1891 still states that "The service charge is 450lbs., consisting of four quarter charges ... each containing 112½lbs. Prism brown powder...". One might be forgiven for thinking that the military had lost interest in the Dover Turret and its R.M.L. guns, and the report, in 1887, of a Consultative Committee, would seemn to confirm this —"... the efficiency of the two 80-ton guns at present in the Pier Turret is diminished by the exposed position of the magazine. It is proposed to make a new shell store below the water line ... but none of the works can be represented as very urgent.". Certainly a Memorandum of March 1887 by the Inspector General of Fortifications gives that impression: "Up to about 1876 the 80-ton guns were the most powerful in the service (but) the introduction of a slow-burning powder ... has caused a complete revolution in artillery, enabling the range and penetrative power of the new type guns to be largely increased ... making it possible for ships armed with these guns to bombard effectively our coast defences without coming with range of the short R.M.L. guns with which the works are armed. The introduction of new type B.L. (i.e. breech-loading guns of long range and high penetrative power into the armament of our coast defences, is therefore obviously of the highest importance.".

In late 1891 the Fort was still evidently very much alive —William Matthews, of Coode & Son, writing to Dover Harbour Board, who wished to use the tunnel through the Fort (the old 'main passage') to "carry our blocks and material on level", stated that "I am certain, from what I have been told today, that sanction will not be given either to the keeping open of the tunnel through the Fort permanently, or even for the time required in the construction of the proposed extension...". This "proposed extension" seems to refer to the extension to seaward of the pierhead — apparently the tide-rip around the end of the pier was not doing the pierhead's original square corners any good. In February 1892 Matthews told the Harbour Board that "provided the Board of Trade concur, the Secretary of State for War will have no objection

Admiralty Pier. November 1897 (Dover Harbour Board)

December 15, 1898 — beginning of construction of staging for Admiralty Pier Extension (Dover Harbour Board)

to the fixing ... of a gangway of the Eastern face of the masonry supporting the Gun Turret..." (i.e. an iron gangway fixed to the outside of the Turret on brackets). Quite what solution the Harbour Board came up with is not known, but the pierhead was extended to seaward, and a considerable quantity of armour plate was included in the extension, giving increased protection to the Turret's seaward side. A plan in the guns' Handbook of 1891, shows the Turret's old main passage as being blocked already — possible it anticipated the event by a little.

The plans of the Turret in the Public Record Office were "corrected to date 2/3/96". By this time the pier-head's seaward extension was complete and the Turret's old main passage and the old magazine were blocked. A photograph of December 1898 shows cranes sited on the top of the Fort to erect staging for the building of the Admiralty Pier Extension. These cranes would have made use of the turret virtually impossible, so it seems that by this date it was officially regarded as obsolete (at one point during building of the Extension a temporary railway line was build over the top of the Fort on trestles to carry materials to the work). HMS 'Inflexible', the only ship ever to be armed with the 16″ R.M.L. was commissioned in 1890. By 1892 she had be down-graded to '2nd Class' and she last appears in the Navy List in July 1903 under "LIST OF VESSELS AVAILABLE FOR SUBSIDIARY SERVICES, HULKS, AND VESSELS FOR SALE" with a note "To be Sold".

And so ended the Dover Turret. It has been described as "the highwater mark of Victorian military engineering...": it has also been regarded as a colossal 'white elephant'. Its doom was foreshadowed as far back as August 1881, even before its guns were installed, by a news item in the 'Dover Telegraph'. This, after stating that the proof trial of No. 2 gun was complete, added that "the future development of heavy ordnance, will (probably) involve a considerable lengthening of the Barrel, and the substitution of breech-loading for the now unpopular system of loading by the muzzle ... the Italians have finished and tested to the their satisfaction their cast iron gun of 100 tons, which is a breech-loader...". It is, perhaps surprising that the Turret was not abandoned far earlier.

PIER TURRET BATTERY

A report of May 25th, 1886 by the Royal Artillery and Royal Engineers Works Committee stated that "The defences of Dover do not stand in need of much revision, pending the construction of the harbour which is about to be undertaken." By the turn of the century, however, this view had changed, and a good deal had been done to improve Dover's defences. Breech-loading guns now replaced many of the old R.M.L.s and new batteries had been built — Citadel Battery, with 9.2″ guns, just west of the Western Heights defences; South Front Battery, with 6″ guns, just in front of the Citadel; and Langdon Battery, also with 6″ guns, on the cliff to the east of the town.

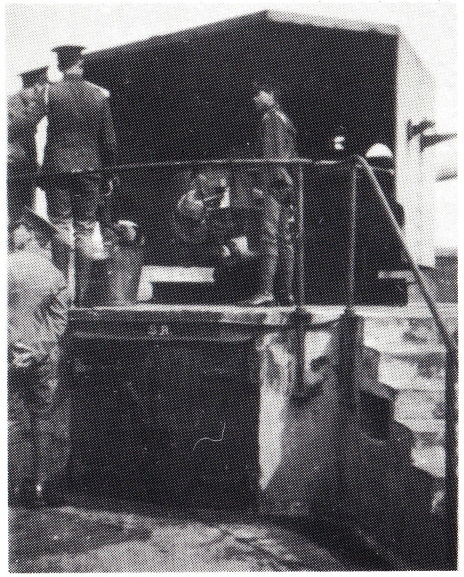
The Admiralty Pier had no defences of its own — in the "SOUTH-EASTERN DEFENCE SCHEME. Revised to 30th September, 1903" it was stated

Widening of the Turret area and construction of Pier Turret Battery April 1907, October 1908 (Courtesy of Dover Museum Collection)

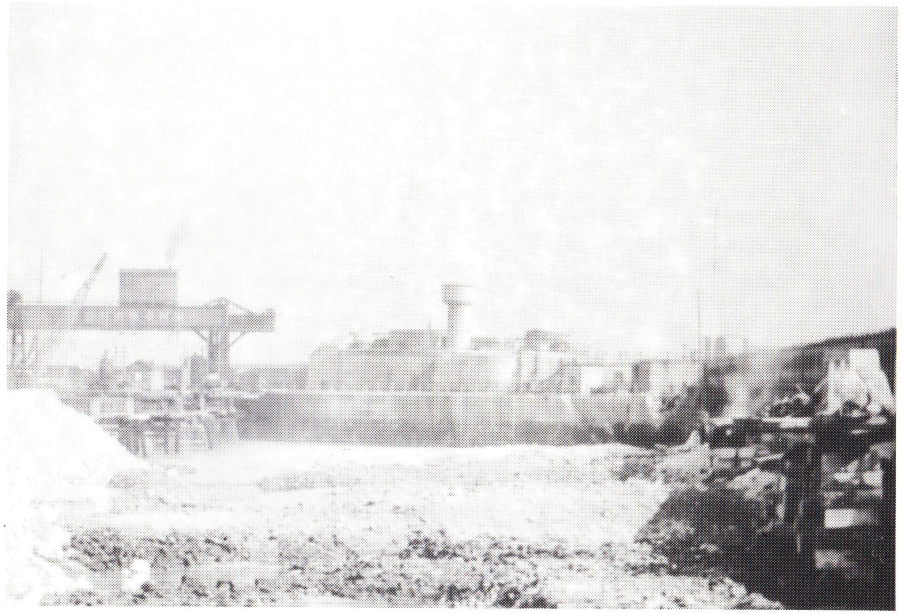
that the Officer Commanding Royal Artillery at Dover should defend the Pier with "40-pr R.B.L. guns of the moveable armament ... from those allotted to Western Heights ... placed near the shore end" of the Pier. In the "DOVER DEFENCE SCHEME. Revised to 31st May, 1907" the Admiralty Pier's armament is shown as "7x12 pr. Q.F. guns ... approved but not mounted."

Things were to change, though. It was evidently realised that the Admiralty Pier (and, indeed, the Eastern Arm and Breakwater) needed to be defended, and work was put in hand. At the Admiralty Pier it was decided to use the old Turret as the basis for a new battery, mounting two 6″ B.L. guns. These were mounted on the top of the Fort on either side of the turret. The Turret's shell store became the new battery's magazine, with ammunition lifts installed to each gun and two search-lights were built on the Pier's parapet, over the old guard room. A photograph of October 1908 shows the work well advanced, with the battery's glacis built and the gun emplacements seemingly ready for the guns. A temporary wooden ramp leads to the top of the old fitters' shop for wheelbarrow access to the top of the Fort and there are piles of sand and loose rubble scattered here and there. By this time, of course, the Pier had been widened at this point to allow the passage of machines and materials for the Admiralty Pier Extension, and the edge of the Turret is no longer the landward edge of the pier.

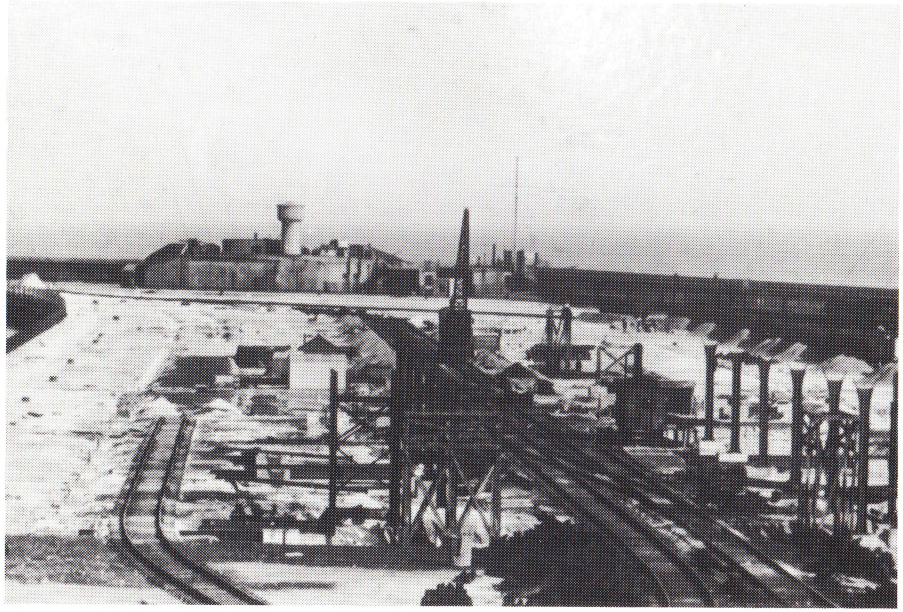
The guns, 6″ Mk VIIs, one from Woolwich and one from South Front battery, were mounted in April 1909 and test-fired on June 16th. The battery was handed over to the Royal Artillery on June 23rd, 1909. It was named Pier Turret Battery.



No. 2 gun. Pier Turret Battery.



c. 1910/1911 during widening of Pier for Marine Station. Lighthouse in course of conversion to battery control post. The cupola for Barr and Stroud rangefinder not yet added (Dover Harbour Board)



A new battery control, or B.C., post was built on top of the lighthouse. This was no longer required as a lighthouse — a new one had been built on the end of the Admiralty Pier Extension (interestingly enough, by the Thames Iron Works who, it will be remembered, had built the turret and its machinery). The B.C. post was equipped with a Barr & Stroud range-finder, and was completed and handed over to the Royal Artillery on May 10th, 1911. The old toilets were enlarged and the quarters modified generally to suit the needs of the new incumbents, and life seems to have gone on as it usually does at a military installation in peacetime. In April 1914 a new searchlight, numbered 1A, was built on top of No. 1 and in July of the same year the old Royal engineers' telephone room, sandwiched between what were originally the artillery store and the guard room, was converted into a bathroom and wash house. A little later in July the battery was manned for war.

According to the battery's Fort Record Book very little happened during the First World War other than the usual routine. Men's and officers' watch huts, together with a signallers' hut were built on top of the Fort, near the B.C. post, in 1916; in August 1917 they were joined by an R.E. Officers' watch hut. The only semblance of action appears to have been the firing of shots across the bows of a trawler in April 1918 (it was "proceeding towards Harbour without recognition flag") and two drifters in October 1918 (these two were "flying incorrect flag").

Finally, on November 11th, came the Armistice, and in 1920 the establishment was reduced to one N.C.O. and three men to look after Pier Turret Battery and Pier Extension Battery (a small battery with two 12 pdrs. taken from Shoulder of Mutton Battery, placed near the end of Admiralty Pier Extension). The guns were greased and stripped and the breech blocks etc. stored in the turret. In July and August, and again in November, the guns were painted. Two rounds were fired from each, and the battery was made available for drill for the Territorial Army.

It was in this period between the Wars that the battery quarters underwent their strangest transfiguration, becoming for several years a family home. What had been the guard room was converted, with the aid of batten and canvas partition walls, into a living room, bedrooms and entrance hall; the old artillery store had already become a cook-house and store — the store now became a laundry room. A new fitters' shop, with its own forge, had already been built: the old fitters' shop was now an office and an officers' room. What remained of the flanking gallery, still with its iron door and two rifle slits, was now known as the lamp room, having presumably been used for storing lamps, and a small lean-to against the toilets' rear wall became the paint store.

In February 1921 two gun shields laying just outside the Battery (and originally intended for the Breakwater Battery) were moved inside the Battery's railings "in view of the projected Public Walk round the Fort to the Extension being shortly constructed". They were dragged on "well greased planks ... with the aid of a winch and a 6 to 1 tackle". The following month a depression

range-finder arrived from Ordnance, and was mounted in the B.C. Post underneath the Barr & Stroud instrument already fitted. The Battery remained under 'care and maintenance', with weekend 'shoots' for Territorials from time to time (usually with 3 pdr. sleeves fitted in the guns) until the Munich Crisis of 1938 when, as has been said, it was manned again, this time by 170 (Kent and Sussex) Heavy Battery, R.A., T.A.

With the start of the Second World War, 170 moved into Pier Turret Battery again. Accommodation was nowhere near adequate and men were forced to sleep in railway carriages on the quay. By the end of 1940, however proper accommodation had been built and conditions were much improved. The additional accommodation consisted of further single-storey buildings within the Battery's perimeter for sergeants' sleeping quarters and mess, and workshop and gun store; officers' sleeping and servants' quarters were built on top of the original guard room and the old artillery store, and a battery office and store were built on top of the new fitter's shop, which became a canteen. Men's sleeping quarters, ablutions and rest room were built just outside the Battery perimeter on the Extension. (The sergeants' mess could hardly have been completed when, in October 1940, it was hit by an enemy shell and wrecked. Two men were killed and three seriously injured.) A two-storey building was also built within the Battery perimeter with accommodation for a Bofors gun crew, the gun being mounted on its roof.

On April 1st, 1944 (some might have thought the date appropriate), Pier Turret became a Home Guard Battery, with only one officer and eight other ranks of Regular Army remaining.

The Fort Record Book ends with the note, penned in bold hand: "In Aug '47 ORD B.L. 6″ MK VII* and mtgs MK II were withdrawn and removed to Woolwich C.R. Depot and Swingate Dump Dover, respectively, by the Armt. Withdrawal Party."

It seems a rather inadequate epitaph.

THE TURRET TODAY

In 1958/1959, all of the remaining buildings of the Admiralty Pier Fort and Pier Turret Battery were demolished by the Dover Harbour Board. A path was cut through the Battery's glacis, going right over the top of the Fort from its landward side to the seaward side and onto the Admiralty Pier Extension, and the old public footpath round the outside of the Battery was closed. No. 1 gun's position was converted into a shelter, with windows looking out to sea, while No. 2's was made into a raised circular platform with a fence around it and a seat or two on top. The lighthouse-cum-B.C. post had been taken down some time before, and now its base, a few inches high, was made into a rather twee 'feature', with panels of large pebbles of contrasting colours. A false roof, raised on three courses of brickwork, was put on the turret and the doors of its gun ports were removed and replaced by simpler doors of sheet steel, each with four ventilation holes. One was mounted on hinges and provided with a hasp and padlock, the other was welded shut.

Inside the Fort there is still much to see. All of the machinery — the engines, the boilers, the ammunition lift and power-rammer, the shell store's 'overhead traveller' — all is gone, and nobody seems to know when it was removed or by whom. Certainly, much, if not all, of it was there until 1938, so one can only assume that it was removed during the Second War for scrap. The shell store is now almost filled by a huge emergency electricity generator belonging to the Dover Harbour Board and, since a new concrete floor was laid for the monster, one can no longer see the hatch to the coal bunker, or the original floor's removeable iron plates, or the hatchway which led to the cartridge store. Further inside, though, in the chamber under the turret one can still look up and marvel at the turret's intricate iron framework, now rusty and dripping with condensation, and the massive roller-race on which all that ironwork revolved. One can still see the rack round its outside in which the pinion's teeth engaged to turn it, and one can still see the iron stages of the loading chamber. Still there, too, are the rusty wrecks of Pier Turrets Battery's 6″ shell lifts, and a large circular hole in the floor which was once a 16″ shell lift.

In one wall of the chamber are two narrow iron doors, hingeing outward, and behind these is an iron ladder down to the basement. The bottom two feet or so of the ladder have long since rusted away, and the basement's floor is thick with mud. During the period between the two World Wars it was, in fact, flooded. The flooding probably resulted from a steady trickle into the basement of rainwater and condensation, together with sea water from waves breaking over the Pier for, according to the Public Record Office plans, the basement is just above high water mark. As stated above, all of the machinery

c.1959 before Dover Harbour Board alteration showing glacis of No. 1 6" gun and base of dismantled battery control post (Dover Harbour Board)

has gone, and so too has the bulkhead between the engine room and coal bunker. The bulkhead which formerly separated the engine room from the ammunition lift is still there, but now leans against the wall, covering the point at which the lift from the cartridge store should emerge. All that is left is a dank, empty, echoing chamber, depressing yet still gloomily impressive. How different it must have been during the Turret's firing trials, with hissing steam engines and sweating men, with the clang of gongs and the ringing of bells, and with the roar of the guns and rumble of recoil overhead! In the ceiling one can see the undersides of the projectile turntables referred to in the R.A./R.E. Works Committee's report, and the broken-off stump of the turret's turning shaft. One can peer up the centre of the plinth, and one can see the iron girders and plates of the coal bunker's ceiling, removable "to allow of boilers &c being taken in or out". And, at the end of the passage which led to the old magazine, one can see, in a recess in the floor, a large valve wheel. Above this is a notice, just decipherable, which reads:

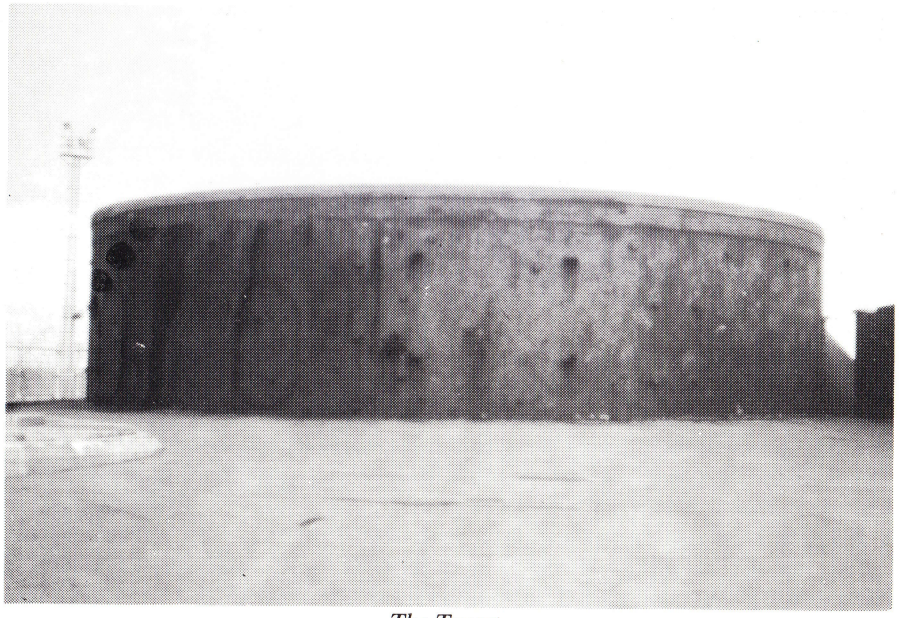
NOTICE
THIS VALVE IS NOT TO
BE OPENED EXCEPT UNDER
THE ORDERS AND SUPERVISI-
ON OF INSPECTOR (OR
ACTING INSPECTOR) OF
MACHINERY & THEN ONLY
AT LOW TIDE

There should be another of these valves by the cartridge lift, hidden by the bulkhead leaning against the wall — they were there to allow water to be drained from the basement (The title "Inspector of Machinery" is one which does not seem to have lasted very long. It was felt that complicated and expensive machinery such as that installed at the Turret should not be entrusted to the care of just anyone, but it seems no officer wanted the job — perhaps it was considered 'infra dig' to associated with nasty, smelly, engines — and so "Regarding the care and working of the intricate and costly machinery of these heavy guns, Inspectors of Machinery have been appointed, with the rank of Quarter-Master in the Royal Artillery, and in due course they will be detailed for service...").

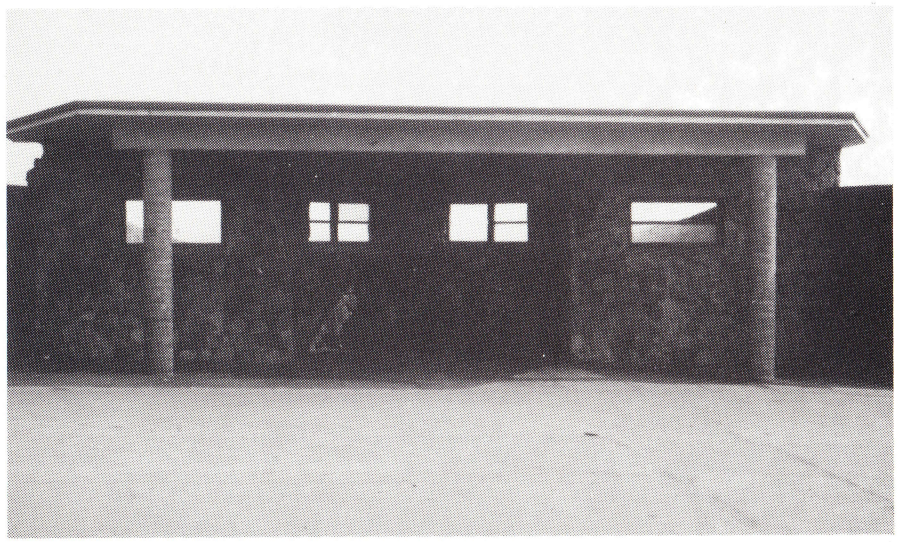
In the turret itself there is nothing left but the guns and their carriages, all of the running-out and hydraulic recoil-control gear having been removed. A false floor of wooden planks has been laid and one can remove one plank and place a torch to shine into a gun's muzzle, and then look through its vent to see the spiral rifling. But the guns are quite impressive enough in themselves. In the 'depressed for loading' position they crouch, dominating the turret by the sheer size and awesome latent power.

English Heritage is now, at last, taking an interest in the Dover Turret. These are the only guns of this type to have survived, and only ones ever to have been mounted on land. The Dover Turret is unique. It is to be hoped that it will be preserved for posterity.

Base of B. C. Post



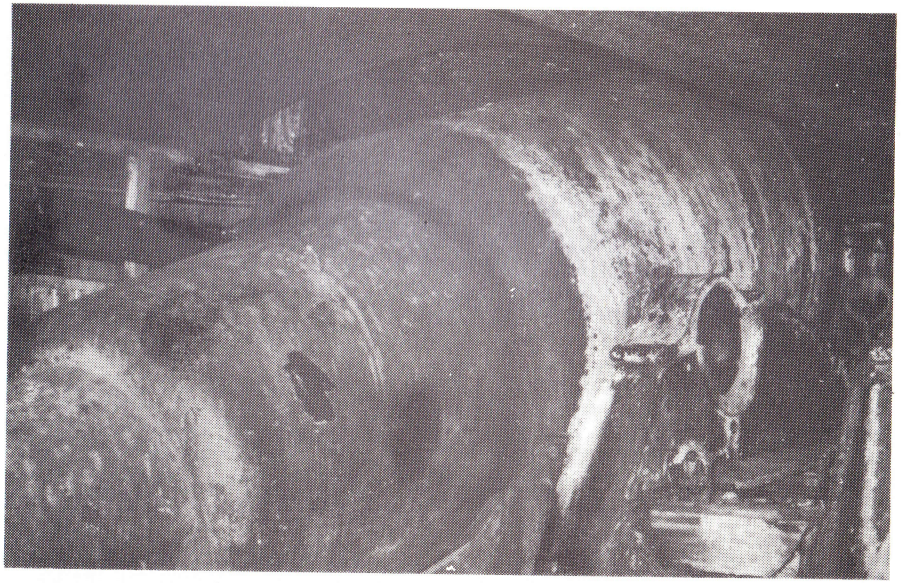
The Turret



Site of No. 1 Gun, Pier Turret Battery

Site of Battery Quarters (flanking gallery to right) and entrance to the Turret

Turning Rack



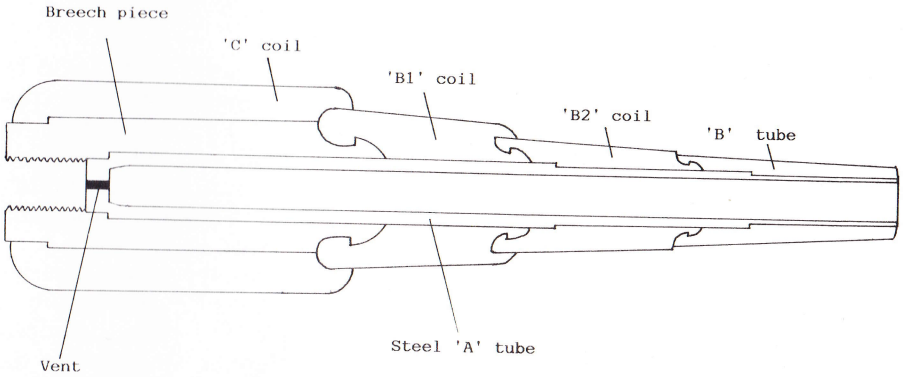
Right hand Gun

6 inch Shell Lift

APPENDIX — TECHNICAL DETAILS

The gun

During the gun's infancy there was widespread disagreement over its weight, some sources referring to it as the "80-ton gun" and others the "81-ton gun". Some changed their minds and ascribed it different weights at different times (or even at the same time —'The Engineer', in its issue of September 15th, 1876, ran an article entitled "HOW THE 80-TON GUN WAS MADE", but headed it with sectional drawings boldly labelled "SECTIONS OF THE 81-TON GUN"!). It was, however, officially known as the "16" R.M.L. gun of 80 tons, Mark I".



Section of 80-ton 16" R.M.L. (D. Burridge)

The gun was built by the Royal Gun Factory at Woolwich, using what was known as the 'Fraser system'. Mr Fraser was a Deputy Assistant Superintendent of the R.G.F. who devised a system of producing masses of metal far larger than were obtainable before by first making a coil, then making a larger coil to fit over the first, but with its helix reversed, and then welding the lot together under the hammer. The coils were made of 20-foot to 30-foot long bars of iron, welded together end to end to make the required total length, and coiled at red heat. They were trapezoidal in section and coiled with the narrow side inwards so that the spreading of the metal would make a sound coil.

The basis of the gun was a steel tube, the 'A tube', machined from a 16½-ton block of steel from Firth's of Sheffield. This was 'crucible steel', made by melting steel in about 240 small crucibles and running it into mould, a method which was "very expensive and eminently unscientific — having, indeed, nothing to recommed it but its success". Once the A tube was machined to shape the breech piece was shrunk on and machined. Over this went the two overlapping B coils and the B tube, and the gun was finish-bored and rifled. Finally the massive C coil was shrunk over the breech piece and its joint with the B1 coil, and fitted with trunnions. The C coil was constructed of two bars

of iron each 173 feet long, and one of 300 feet, to give a mass of metal weighing, before machining, almost 58 tons. The total weights of metal used were as follows;

Name of piece	Weight before machining		Weight after machining	
	tons	cwt	tons	cwt
A tube	16	10	7	13
Breech piece	29	8	17	10
B1 coil	27	6	13	8
B2 coil	6	5	4	3
B tube	8	1¼	3	8
C coil	57	19	34	5
Total	155	9¼	80	7

Design of the gun was made more difficult by the fact that it was to be mounted in a turret. This imposed limitations on its length if gun and crew were to remain under cover during loading, meaning that a fast burning powder had to be used to give the projectile a high velocity in a short barrel. This, in turn, entailed a tremendously strong breech to withstand the sudden pressure. The 80-ton gun had a length of 26 feet 9 inches and a maximum diameter of 6 feet and the length of its bore, including the chamber, was 24 feet.

The rifling consisted of 33 evenly spaced grooves, with the twist increasing from the chamber towards the muzzle, so as to start the projectile revolving slowly lest the gas-check failed under the strain. The rifling stopped abruptly just short of the chamber to prevent over ramming. Venting was axial and the gun could be fired with either friction or electric tube.

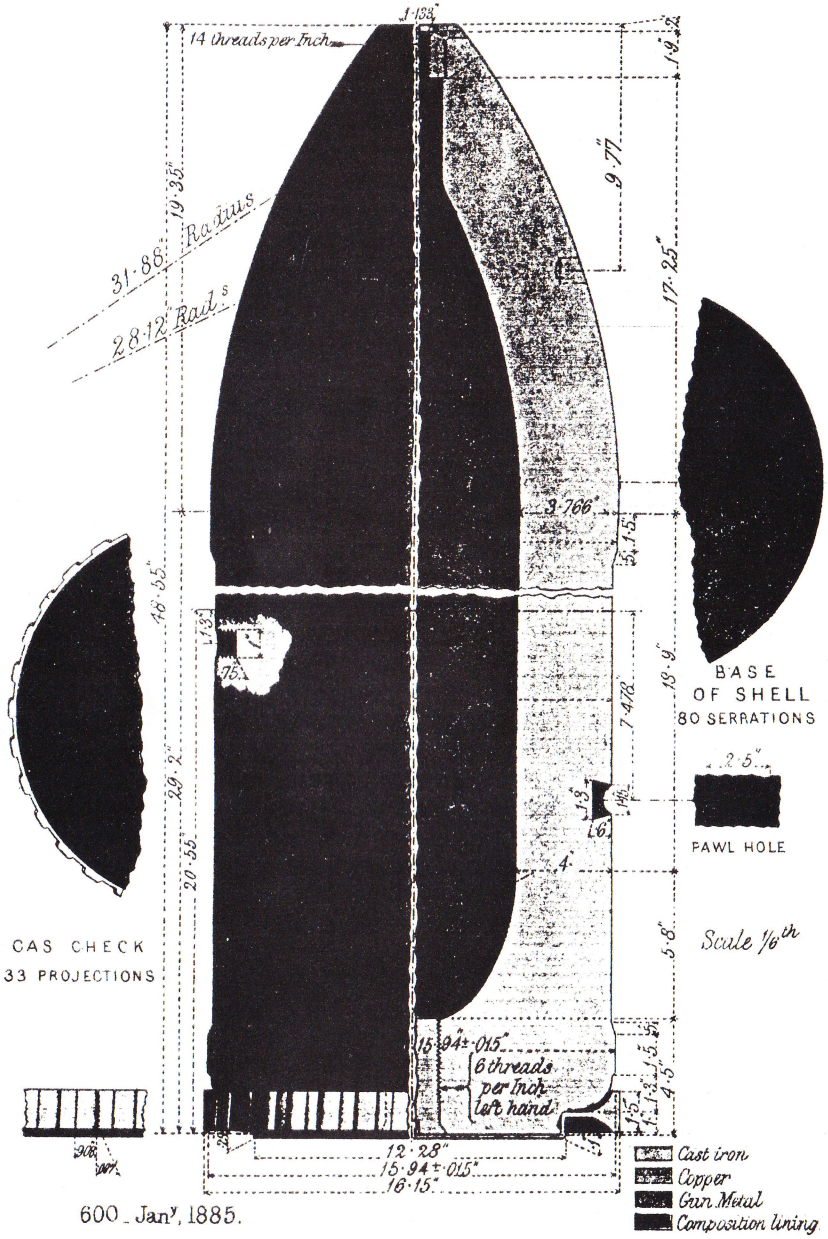
Ammunition

The service charge for the guns was 450 pounds of brown prism powder (despite the comments of the Royal Artillery/Royal Engineers Works Committee in their 1886 report), contained in four silk cartridges, each holding 112½ pounds, and primed at each end with seven prisms of black powder. The cartridges were stored and transported in zinc cylinders.

Projectiles were either shells, with a 60 pound bursting charge, or solid shot. Shells weighed 1640 pounds, plus bursting charge; solid shot weighed 1684 pounds, weighted to 1700 pounds with sand (these weights include 21¼ pounds for the copper gas-check). The projectiles were 48½ inches long, and had threaded holes for the attachment of eyebolts in the base and in one side, close to the centre of gravity, and a square hole in the opposite side for the pawl of the transporting trolley (see 'Operation' section).

Shells were fitted with a fuse ("quiescent in all its parts till direct impact takes place") which screwed into the nose.

The muzzle velocity was given as 1590 feet per second, with muzzle energy 29,806 foot tons. Extreme range is quoted as just under 7 miles, but with the limited elevation allowed by the Dover Turret, the range table only goes up to 8,000 yards, at which distance it was reckoned that the projectile would arrive, after a flight of 20.81 seconds, with a velocity of 995 feet per second.



The turret and machinery

The turret was built by the Thames Iron Works and Ship Building Company, Ltd, of Blackwall, with framing of wrought iron. It was clad with three layers of 7″ armour, with 2″ layers of iron and wood between them. The total weight of turret and guns is given as 895 tons and it revolved on 32 steel rollers.

The machinery, too, was built by the Thames Iron Works. There were five steam engines:

1 The Loading Engine, which powered the running-back gear and that for elevating and depressing the guns, together with the ammunition lift and rammer,
2 The Main Engine, which worked the shaft for turning the turret,
3 The Auxiliary Engine, which could do the work of either of the other two, but not of both simultaneously,
4 The Dynamo Engine, which drove the dynamo for the 33 volt light system, and
5 The Donkey Engine, which supplied water to the boilers and drove a Tangye's 'Special' pump to supply high-pressure water to hose out the guns' bores between rounds.

Steam was provided by two boilers "of a locomotive type". Either was capable of producing enough steam to work the machinery but normally both would have been used. Steam was to be "got up gradually and quietly in not less than two hours from lighting the fire, when possible", but could, of course, be got up in considerably less time; certainly within the time it would take a target to get within range once having been sighted. Thames Iron Works reckoned that "The total weight of iron and steel work in the Turret, engines, Boilers, and Gearing, exclusive of Armour and Guns" was 400 tons.

The ammunition lifts, one for each gun, were chain driven. cartridges and shell were lifted in tubes, the shell tube being lifted on top of the cartridge tube (see next section).

Operation

The operation of the Dover Turret needed a large personnel. There were:
The Turret Commander,
Assistant Commander (a junior officer or N.C.O.),
Engine Driver, to drive Main engine and superintend in Engine Room,
Assistants to attend to Loading and Dynamo Engines,
Fireman, and
Two gun's crews, each of 13 men.

The Turret Commander occupied the left-hand manhole in the turret's roof while the Assistant Commander took the right. Of each gun's crew, only five men were actually in the turret working the gun — the other eight were scattered throughout the Fort issuing and collecting cartridges and shells, and lifting them to the loading chamber and ramming them.

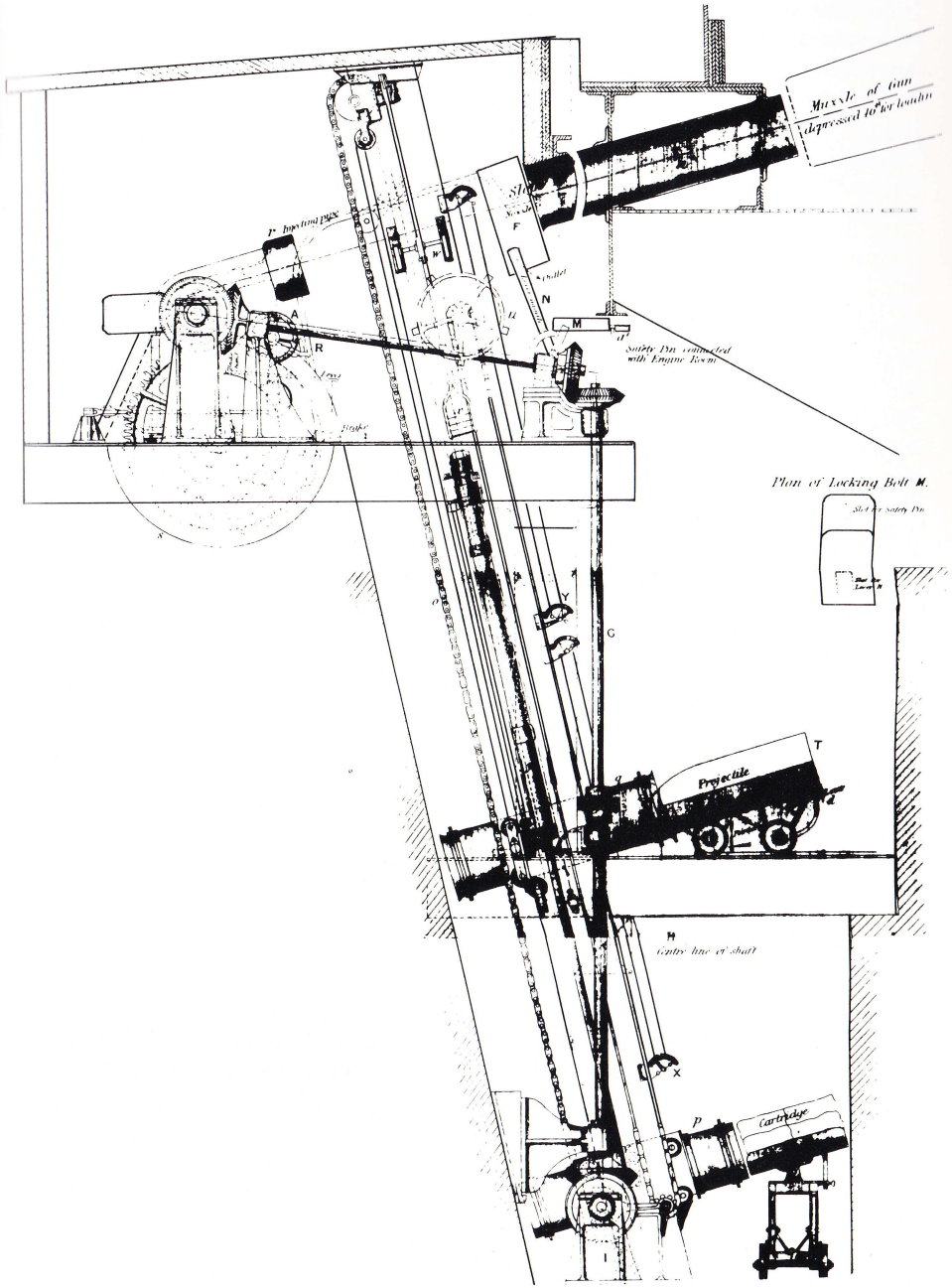
To explain the working of the Turret it will be easiest to take one entire sequence of operations from the firing of one shot, or salvo, to the firing of the next.

Loading:

To rotate the turret to the loading position after firing the guns the Commander gave the order by training wheel or by electric signal or, if both of these methods failed, verbally by voice pipe. To rotate by training wheel, the Commander turned his wheel until the 'Zero' graduation marked on it coincided with its fixed pointer. This turned the outer pointer of a dial in the engine room and rang a bell to attract the engine driver's attention. The engine driver then engaged the main engine's clutch and rotated the turret until the inner pointer on his dial coincided with the outer (in this instance, at 'Zero'). To rotate by electric signal, the Commander had a three-position switch. If he turned the switch to the right and put its handle down a gong rang in the engine room and a disc marked 'F' appeared. The engine driver then rotated the turret forwards, i.e. clockwise, for as long as the disc was displayed. Turning the switch to the left and putting its handle down caused a disc marked 'B' to appear, in which case the turret would be turned backwards, or anti-clockwise. To signal 'loading-position' the handle was put down with the switch in its central position, causing both discs to be shown together. The turret could be halted at any time by turning the switch handle up, causing whichever disc was being displayed to disappear.

Once the turret was at loading position the engine driver de-clutched the engine, removed the safety pin from the turret locking bolt, and notified the loading chanber that this had been done with one touch on a bell-push. In the loading chamber, the No. 4 of each gun's crew pushed home the locking bolt by means of a lever and gave the engine room an answering touch on his bell-push. He then checked his 'hydro-pneumatic accumulators' (tanks holding water at high pressure) and, if their gauges showed less than 100 pounds per square inch, gave the engine room two touches on the bell-push. The engine driver responded with two bells and started the pumps. Once the pressure was up to 100 psi the engine driver was given three bells. He answered with three bells, stopped one pump and left the other running slowly.

Meanwhile, on the gun floor the guns, having been driven back by recoil, were locked in position with brakes. Pushing home the turret locking bolt sounded a gong in the turret's roof, moved the inner pointers on the direction plates of the depressing wheels to 'Depress for loading' and locked a clutch on the depressing lift under each gun's breech so that it could only be raised, thus depressing the muzzle. In the loading chamber the locking of the turret released one of the two stops which made the rammer inoperative. As the guns' muzzles were depressed to the loading position they pressed down on a bar, releasing the rammer's other safety stop and moving the pointer on an indicator plate in the loading chamber to 'Depressed for loading." Each No. 4 now pushed his washing-out lever to 'Open' and hosed out the bore of his gun



Loading gear. Illustrated from the gun's Handbook (Royal Artillery Institution Library)

until the pressure indicated on his 'accumulators' fell to 70 psi, when he returned the lever to 'Close' and notified the engine room, as before, to pump up the pressure again.

The Nos. 11 and 13 of each gun's crew were in the shell store which was equipped with an 'overhead traveller', consisting of two rails slung from the ceiling along which a transverse girder ran on wheels. A small trolley ran along the transverse girder, and to this could be hooked or shackled a differential hoist. By this means shells could be picked up from, or set down in, any part of the store. The Nos. 11 and 13 hoisted each shell by an eyebolt screwed into its side, close to the centre of gravity, and took it on the traveller to the shell store entrance, where it was lowered onto a trolley. The Nos. 7 and 9 of each crew pulled their shells on the trolley along rails set in the floor (for the right gun base first, for left gun nose first) to a turntable at the ammunition lift and swivelled the trolley to line up the shell with the projectile tube on the lift. The trolley was locked into place by means of a hook underneath which engaged a catch on the floor. No. 7 now screwed an eyebolt into the base of his shell, and the rope attached to it was given a turn round a cleat fixed to the masonry. No. 7 now pulled a lever on the side of the trolley, releasing the catch by which the shell was held, and it slid into the projectile tube nose first, controlled by No. 9 on the restraining rope. The eyebolt was unscrewed and No. 9 released the trolley from the catch on the floor and returned to the shell store with it, while No. 7 attached a gas-check to the base of the shell and awaited the instruction for it to be lifted.

In the basement, the Nos. 10 and 12 issued cartridges, four at a time, to Nos. 6 and 8 who placed them in trolleys, each trolley having two cradles, each of which took two cartridges. No. 6 pulled, and No. 8 pushed, their trolley to the foot of the ammunition lift, where No. 6 released a catch on the first cradle, tipping two cartridges into the cartridge tube. The trolley was then moved up and the other two cartridges were tipped into the tube. No. 8 then returned the trolley to the cartridge store. No. 6 moved the pointer of the signal dial to 'Lift'. This moved the pointer of the dial on the floor above to 'Lift' and sounded a gong. No. 7 on the floor above now moved the pointer on his signal dial to 'Lift', moving the pointer on the dial in the loading chamber and sounding a gong there, and No. 4 in the loading chamber turned his control wheel to 'Lift', setting the lift in motion.

As each cartridge tube passed upwards through the shell floor it picked up the shell tube and carried it up with it. When the cartridge and shell tubes arrived in the loading chamber, one on top of the other, the lift was stopped with the cartridge tube opposite the loading tube. The cartridges were then rammed, through the loading tube, into the gun. The cartridges having been rammed, the rammer was withdrawn and the cartridge and shell tubes lowered on the lift until the shell tube came to rest on pawls opposite the loading tube. The shell was now rammed into the gun. As soon as the two Nos. 4 in the loading chamber had loaded their respective guns and withdrawn the rammers, they released the turret locking bolt. This sounded a gong in the turret,

unlocked the clutches on the depressing lifts so that the guns could be elevated, and moved the inner pointers on the depressing wheels to 'Elevate for running out'. The turret locking bolt's safety pin slipped back into place automatically, thus notifying the engine driver that loading had been completed and that the turret was free to rotate. As soon as his gun began to elevate, or the turret began to turn, each No. 4 raised the lift slightly so as to lift the shell tube off the pawls, turned the pawls up and turned his control wheel to 'Lower'. As each tube arrived back at its own floor it rang a signal bell and moved the pointer on that floor's signal dial back to 'Lower'.

Running-up and laying:

As soon as the gong had rung in the turret and the pointers on the depressing wheels moved to 'Elevate for running out' the guns were elevated and the brakes released, allowing them to run back down their slides. When fully run out, their muzzles protruded from the gun ports by about a yard. The guns could be laid by the gun captain on the gun floor, using reflecting sights (there was insufficient room to sight from behind the gun) but laying would normally be done by the Commander from his position in the turret's roof. If the guns were laid from the gun floor, the gun captain would give the elevation directly to the No. 2, who would operate the depressing wheel accordingly, No. 3 locking the gun in position with the jamming lever when the appropriate elevation was reached. The bearing would be indicated to the engine driver by means of a training dial on the gun floor.

The Turret Commander was equipped with sights and could, of course, signal the approximate bearing to the engine driver by means of the training wheel while the guns were loading, the engine driver then commencing to rotate the turret as soon as the locking bolt was withdrawn. Similarly, the approximate elevation could be signalled to the gun floor in advance, by means of a dial in the manhole which moved a model gun on a dial on each gun. By means of disconnecting levers the same elevation could be signalled to each gun in turn or to both simultaneously, or each could be signalled a different elevation. Fine adjustment of bearing and elevation could be made when the sights came to bear.

The Commander's 'piece de resistance', though, was the telescopic sight. This was laid on the target by means of the training wheel, thus signalling to the engine driver the bearing, and, since the sight's height above sea level was known (tide-tables were provided) the range could be calculated very precisely from the telescopes angle relative to horizontal, and signalled to the gun floor in advance. The guns being elevated to the degree signalled as the turret rotated, they would be fired as soon as it came to rest.

Firing

As stated before, the guns could be fired by friction or electric tube. Firing by friction tube would, of course, be done on the gun floor, and normally only when the guns were laid by reflecting sights. Electric tubes would be used if

the Commander was firing from his position in the roof manhole. The ultimate purpose of the telescopic sight was to fire the guns while the turret was rotating, thus not only saving time, but exposing the gun ports, its only vulnerable points, to enemy fire for the least possible time. For this purpose the telescope would be kept trained on the target by means of a traversing screw while the turret was rotated and, provided the firing switch was kept closed, the guns fired as soon as they were parallel with it (plus or minus any adjustment for deflection). The guns could be fired either together or singly. If the latter, it was necessary to halt the turret after the first gun fired and re-lay it, since the unbalanced recoil would tend to swing it slightly.

In the event of a mis-fire the turret would be halted, if in motion, and the order 'Stand fast' given. After a wait of one minute the offending tube, whether friction or electric, would be withdrawn and another tried. There was a delightful story told of these guns, and another similar story told of the 100-ton guns at Gibraltar (and claimed to be true) of a weedy youth who won instant promotion by wriggling down the bore of his gun to attach a rope to the nose of the shell after a misfire, so that it could be withdrawn. I am inclined to doubt the story (and suspect that there is probably a similar tale told of the other 100-ton guns, at Malta), but it may have some basis in an incident which happened while one of the 80-ton guns was being tested at Shoeburyness. A pressure gauge was fitted to the base of the test projectile, and another fitted in a copper cup, which was placed on the rear of a cartridge and rammed with it (this to measure the pressure generated inside the gun). On one occasion this copper cup stuck in the bore, and had to be retrieved, according the 'The Engineer' of September 24th, 1875, by "a man being put into the bore head first, and pushed, or literally rammed, down —for there was no room to crawl — till his toes were in the muzzle, a feat which deserved a reward from the Waltham Abbey superintendent, as showing great confidence in the character of the products of combustion.".

The observant reader my have noticed that, in the account of the working of the Turret, shells were issued from the *new* shell store, while cartridges were issued from the *old* magazine. This is, however, the way it seems to have been. The new shell store was built wholly within the pier-head's landward extension. So was the new cartridge store. It seems inconceivable that someone hacked and chiselled his way down through 40-odd feet of solid concrete to carve out the new cartridge store, so one is forced to conclude that it was 'built in' as the pier-head was extended. The R.A./R.E. Works Committee's report of March 24th, 1886 was clearly written after the pier-head extension work, for it gives details of the electric lighting system, and the dynamo and its engine were mounted in a recess off the passage from the new shell store, i.e. a passage which previously did not exist. And, if the pier-head had been extended, the new cartridge store must have been in existence. According to the report, the Committee found that "the whole was found to be in a serviceable condition...". The phrase "the whole" must include the new cartridge store, since it was there by then, but later in the report there is a reference to

improvement necessary to "the passage from the cartridge store, to allow more room for trolleys to pass...". This can only be the passage from the old cartridge store, i.e. the old magazine. The Royal Artillery Institution's copy of the guns' Handbook, dated 1891, is even more contradictory. The whole of the section on the working of the Turret has been paraphrased from the Handbook, for a start. But in the Handbook's section 'NOMENCLATURE OF GEAR' we find, in the shell store, "Hatchway to magazine" (which can only be the new cartridge store). In the 'cartridge (expense) store' we find "Cartridge trolleys" *and* "Top of lift from magazine" and in the 'Cartridge Store (Magazine)' is the "Bottom of lift to expense store". All of these confirm the existence of the new cartridge store, but the cartridge store's lift emerged at the foot of the ammunition lift or, rather, between the bottoms of the two ammunition lifts, so what need was there for cartridge trolleys? Cartridges would simply have been taken from one lift and placed on another. And to make the confusion worse confounded, a small plan in the Handbook shows the Turret's old main passage as blocked. Now, if this passage had been filled in, so had the old magazine, for the Public Record Office plans show large sheets of armour plate in the magazine infilling: sheets so large that they could only have been put there from the old main passage.

There seem to be two possible answers. Either:

A For some time after the new cartridge store was built, the main bulk of cartridges were stored there, but some were kept in the old magazine for 'ready use', or

B There was some difficulty with the new cartridge store's lift, or with something else about it, and cartridges had perforce to be kept in the old magazine.

Either way, the plan in the Handbook which shows the old main passage as blocked seems to have anticipated the event by a little for, as stated earlier, William Matthews, of Coode & Son, was writing to the Dover Harbour Board in December 1891 "I am certain ... that sanction will not be given ... to the keeping open of the tunnel through the Fort...". All that one appears to be able to say with any degree of certainty of the new shell store is that it was built when the pier-head was extended to landward, and that it was in use by March 1896 (when P.R.O. plans were last 'corrected to date'), since these show the old magazine as having been filled in.

SOURCES

Sources consulted during the research for this book were, not in order of importance but alphabetically:-

British Library: Quarterly reports of Edward Druce to the Board of Trade, in Parliamentary Papers.

Contemporary Newspapers etc:

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Dover Chronicle, June 25, 1881 & June 16, 1883,

Dover Telegraph, August 10 & 17, and December 14 & 21, 1881,

Dover Standard, December 10 & 17, 1881 and January 7 & 14 1882,
Dover Express, July 20, 1883,
The Engineer, September 24, 1873 & September 15, 1876.
Guildhall Library, London: Thames Iron Works' catalogue for the Royal Naval Exhibition, 1891.
Kent Archives Office, Maidstone: Various documents, including Matthews' letters to Dover Harbour Board, in file No. DHB/E1.
Ministry of Defence, Whitehall Library: Many documents, including Inglis' report on transporting and mounting the 80- and 100-ton guns (with photographs), Annual Reports of the Director of Artillery & Stores, R.A./R.E. Works Committee reports, and Committee on Sea-Coast Batteries' report, in Vols 9, 11, 21, 29, 30 and 31 of the Engelbach Collection, and precis of correspondence relating to the Defences of Dover, prior to April 1893.
National Maritime Museum, Greenwich: Navy Lists.
Public Record Office, Kew: Plans of the Admiralty Pier Fort (PRO reference WO78/5106), various reports, including Abstracts of proceedings of the Department of the Director of Artillery, in WO33 series, and Pier Turret Battery's Fort Record Book (PRO reference WO192/196)
Royal Artillery Institution Library, Woolwich: "Handbook for the 16" Rifled Muzzle-Loading Gun of 80 Tons, Land Service", a priceless relic. The Library keeps it under reference number G3B/CD/12.5"-18".
The only secondary source used was an article by H. A. Baker on the 80-ton gun in issue No. IV of 'Ravelin', the Kent Defence Research Group's newsletter.

ACKNOWLEDGEMENTS

My thanks are due to the following, again in alphabetical order:
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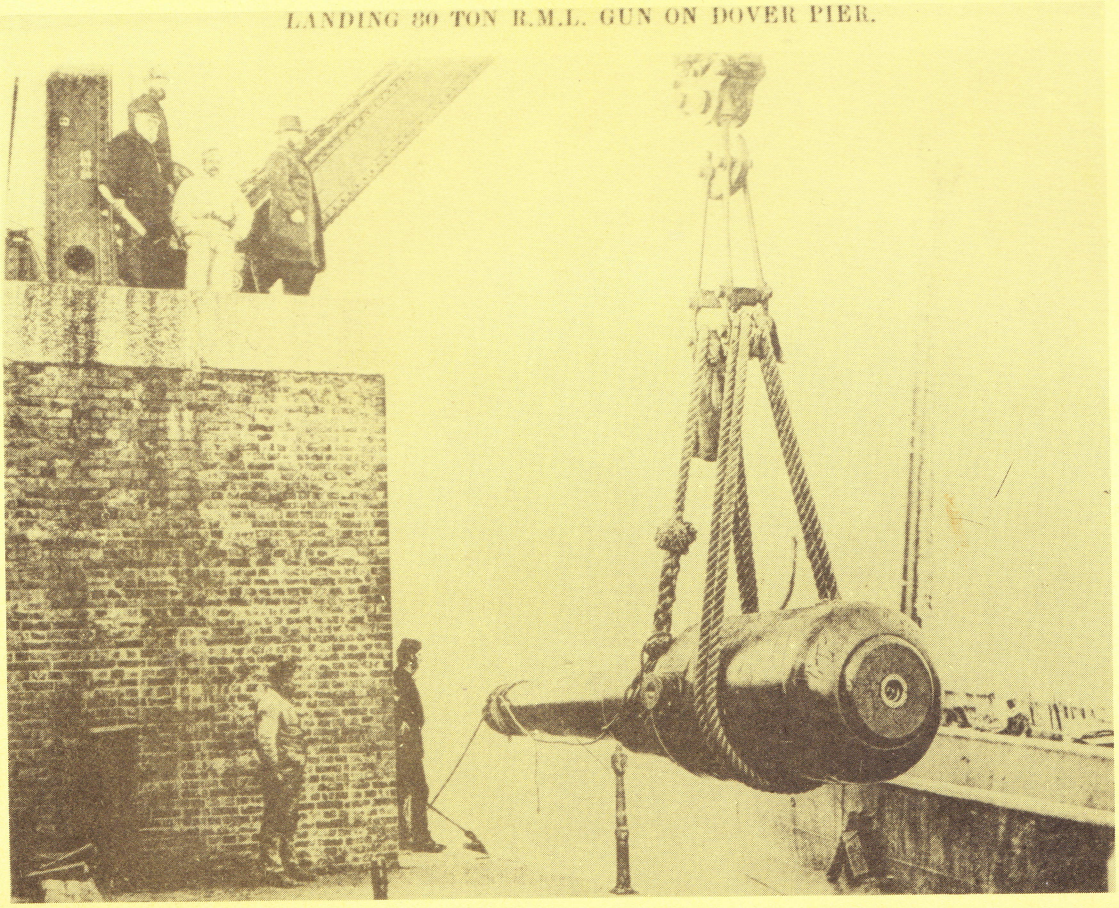
Finally, but most importantly, I have to thank my wife, Betty, who not only aroused my interest in the Dover Turret in the first place, but has put up with my subsequent researching, and with this book's at times painful gestation, with commendable fortitude.

LANDING 80 TON R.M.L. GUN ON DOVER PIER.